Monitoring the Evolution and Benefits of Responsible Research and Innovation (MoRRI)

D5.3 Progress report

RRI benefits and economic effects: summary and assessment of empirical data

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Sub-task 6.4, In-depth case studies of the scientific disciplines and industrial sectors, Deliverable D5.3

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- **Citizen engagement and participation of societal actors in research and innovation**, Task 2, Analytical report, Deliverable D2.1, April 2015
- **Science literary and scientific education**, Task 2, Analytical report, Deliverable D2.2, April 2015
- **Gender equality**, Task 2, Analytical report, Deliverable D2.3, April 2015
- **Open access**, Task 2, Analytical report, Deliverable D2.4, April 2015
- **Ethics**, Task 2, Analytical report, Deliverable D2.4.1, April 2015
- **Governance**, Task 2, Analytical report, Deliverable D2.4.2, April 2015
- **Synthesis report on existing indicators across RRI dimensions**, Task 3, Progress report, Deliverable D3.1, May 2015
- **Metrics and indicators of Responsible Research and Innovation**, Task 3, Progress report, Deliverable D3.2, September 2015
- **Update of the literature review & Visioning exercise**, Task 6, Progress report, Deliverable D5.1, January 2016
- **In-depth case studies on the benefits of RRI across the scientific disciplines and industrial sectors**, Task 6, Deliverable D5.2, April 2016

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List of Abbreviations

CRIS	Current research information systems
CS	Case Study
EC	European Commission
FP	Framework Programme
GE	Gender Equality
KPI	Key Performance Indicators
MML	Mobilisation and Mutual Learning
OA	Open Access
PAR	Participatory Action Research
PE	Public Engagement
PTA	Participatory Technology Assessment
RATA	Risk Analysis and Technology Assessment
RCoR	Responsible Conduct of Research
RI	Research Integrity
RoI	Return on Investment
RRI	Responsible Research and Innovation
R&I	Research and Innovation
SLSE	Science Literacy and Scientific Education
WoS	Web of Science
XTP	Xenotransplantation

1 Introduction

The European Commission funded project MoRRI aims to monitor the evolution and benefits of Responsible Research and Innovation (RRI). Task 6 specifically focuses on the analysis of possible RRI benefits for the economy, democracy, and society.

Two progress reports provided input and groundwork for this last deliverable of Task 6: Deliverable 5.1 updated the state of the literature review of Task 1 (Sub-task 6.1) and summarised the information and insights gained in the Visioning Exercise (Sub-task 6.2). Deliverable 5.2 provided the results of a broad case study programme conducted by MoRRI consortium partners (Sub-task 6.4), trying to identify the social, democratic, and economic benefits of RRI in general or of certain dimensions of RRI in particular.

Deliverable 5.3, the progress report at hand, draws on and synthesises those results. First, it provides a list of possible RRI benefits (Sub-tasks 6.3 and 6.7). Those mostly derive from the literature review and from the analysis done in the case study programme. Furthermore, potential benefits suggested by the expert participants of the Visioning Exercises are included.

They are presented along five RRI dimensions (Public Engagement, Science Literacy and Science Education, Gender Equality, Ethics and Governance, Open Access) and are then further divided into democratic, economic, and societal benefits, as well as potential benefits for science and research itself.

Second, the report presents a preliminary assessment of the quality and availability of quantitative and qualitative empirical evidence on RRI benefits (Sub-task 6.5). This assessment is based on the data collected in the case study programme. It is divided into an assessment of data in the first round of case studies on the one hand – which screened and analysed material of existing EU projects – and the second and third round on the other hand, where MoRRI consortium partners conducted empirical case studies. This chapter describes the existing possibilities and limitations considering the quantitative and qualitative evidence on RRI benefits.

Third, the logical links between RRI dimensions and applicable benefits are elaborated (Sub-task 6.6). Although finding these links and causalities was challenging, the evidence and information found can be used for building a monitoring system backed by evidence.

Finally, an estimation of the economic effects of RRI as indicated in the case studies is given in a separate chapter provided by Joanneum Research, showing the limitations and potentials of such measurements.

Annex I provides an overview of all cases investigated in the case study programme, including the respective areas where benefits could be identified. Annex II presents a list of the screened EU projects of the first round of case studies, and the viability of data and rationale behind excluding or including them into the programme. Annex III includes the analysis sheets that were used in the synthetisation of the whole case study programme (first, second, and third round).

2 List of appropriate RRI benefits

This part of the MoRRI project identified the benefits of RRI by three consecutive steps:

- First, review of relevant literature (Task 1 and Sub-task 6.1, see Deliverable 5.1 Progress report on the analysis of RRI benefits: Update of the literature review.[1]).
- Second, a visioning exercise with experts and stakeholders (Sub-tasks 6.2, Deliverable 5.1 *Progress report on the analysis of RRI benefits: Visioning exercise*; see also Table 7).
- Third, empirical case studies that addressed various elements of RRI and covered different organisations, technologies, and countries (Sub-task 6.4, see Deliverable 5.2 *In-depth case studies of the scientific disciplines and industrial sectors.*[2]).

During the analysis, it turned out that two changes were necessary about the definitions of areas of impacts of RRI.

- First, the distinction between "democratic" and "societal benefits" was clarified. In this report, the term "societal benefit" designates various forms of impact of RRI on society in a broader sense, whereas the term "democratic benefit", in comparison, is restricted to the impact of RRI on the democratic and political system of society.
- Second, we created an additional area of benefits, i.e. "science and research", as it turned out that numerous forms of positive impact of RRI exist on science and research.[3]

The three rounds of the MoRRI case study programme provided a broad empirically grounded insight into the benefits and wider impacts of RRI (see MoRRI Deliverable 5.2 and to Table 7 in this report). The MoRRI consortium collected and analysed new or employed existing data on possible benefits and wider implications of RRI activities in democratic, societal, and economic terms as well as for science itself. In this way, it was possible to develop a better understanding of the unfolding and the impacts of RRI and its dimensions. As depicted in the provisional list of RRI benefits (

[1] Kukk, P., Lindner, R., Warnke, Ph. (2015). Monitoring the Evolution and Benefits of Responsible Research and Innovation. Progress Report D5.1. Update of the literature review (Sub-task 6.1) & Visioning exercise (Sub-task 6.2). European Commission.

[2] Wuketich, M., Lang, A., Griessler, E. (2015). Monitoring the Evolution and Benefits of Responsible Research and Innovation. Progress Report D5.2. In-depth case studies of the scientific disciplines and industrial sectors. European Commission. Deliverables 5.1 and 5.2 will be publicly available on http://www.technopolis-group.com/morri/.

[3] This last category, however, is not included in the indicators to measure the benefits of RRI because it was developed when the definition of these indicators was already finished.

Table 2 to Table 7), the case studies uncovered substantial evidence for the potential benefits of a holistic RRI approach or its dimensions on society, economy, and democracy. Furthermore, another area of impact was established: on the quality and conduct of science itself.

Although, the case studies provided many instances for diverse benefits of RRI, the evidence supporting RRI benefits was stronger in some areas than others because of lack of data or poor data quality[4].

Table 1 provides an overview on the case studies carried out (CS01 to CS21).

Table 1: Case study programme

No.	Case Study
01	Bridging the gap between science, stakeholders and policy-makers. Phase 2: Integration of evidence-based knowledge and its application to science and management of fisheries and the marine environment (GAP2)
02	Impact of Citizen Participation on Decision-Making in a Knowledge Intensive Policy Field (CIT-PART)
03	Women in Innovation, Science and Technology working group (WiST)
04	Promoting inquiry in mathematics and science education across Europe (PRIMAS)
05	Institutional Efforts to Ensure and Enhance Responsible Conduct of Research: Lessons Learned from Aarhus University
06	Gender and affirmative action: Lessons Learned from the Danish Council for Independent Research (YDUN)
07	Research Council of Norway
08	Austrian Agency for Research Integrity
09	European Molecular Biology Organization (EMBO)
10	UK Science Media Centre
11	Open Air Laboratories (OPAL)
12	National Open Access Policy in the Netherlands
13	Participatory Action Research (PAR) in Environmental Management
14	Nanotechnology RRI in the Netherlands
15	Infineon Technologies Austria AG
16	AVL List
17	FemPower Bonus for Female Project Leaders
18	Gender Criteria of the Austrian Science Fund (FWF)
19	Institute of Gender in Medicine at the Charité University Medicine Berlin
20	The European Bioinformatics Institute (EMBL-EBI)
21	ETH Zürich

[4] See in detail Wuketich, M., Lang, A., Griessler, E. (2015).

Table 2: Potential benefits of Public Engagement

Democratic	Economic	Societal	Science
Involvement and participation contributes to citizen empowerment and more qualified decision-making (Smith, 2005; CS01, CS02, CS03, CS11, CS13). Including citizen knowledge into policy-making strengthens the democratic system (CS01, CS02, CS13; Newton and Geissel, 2012). However, unreflective public engagement (…) can close down vital debates in contentious areas (Stilgoe et al., 2014, p. 11).	Stakeholder involvement leads to cost-effective new outcomes and procedures (CS01, CS11, CS13, CS14). Public engagement mobilises additional research funding (CS02, CS11). Collective data collection and data usage generate cost savings (CS02, CS11). Knowledge can be generated about previously inaccessible areas (CS11).	Public gains knowledge and competences, which again can lead to higher awareness and more openness towards certain topics (CS01, CS02, CS11, CS13, CS14). Debate/communication between actor groups leads to new actor coalitions, new networks and increased trust building – especially between powerful and marginalised groups (CS01, CS02, CS11, CS13, CS14).	Public engagement methods help researchers to acquire new skills (CS13). Addressing societal needs and RRI aspects leads to new and different research questions and outcomes (CS11, CS13). Participatory methods help to access previously unavailable data (e.g. Citizen Science) (CS02, CS13). Improves higher education curricula (CS11, CS13). Inclusion of public into science and agenda setting (CS02, CS11, CS13). Public engagement increases sciences' direct and indirect contribution to and exchange with society (Vargiu, 2014; CS13).

Table 3: Potential benefits in Science Literacy and Scientific Education

Democratic	Economic	Societal	Science
Scientifically literate policy makers can make better-informed decisions and are able to assess risks and benefits of research and innovation (CS10, CS13).	A scientifically literate public has a broader acceptance of R&I and its products, which again might lead to competitive advantages (CS10, CS13). Science literacy and science education increase the number of a highly competent labour force (CS04).	Measures, promoting science literacy (information, training and participation) help society to better understand and participate in science (Miller, 1983; CS04, CS10, CS13). Both low and high ability students benefited from teaching, which contributes to an equal society in terms of chances for education (CS04).	Science literacy and science education raise awareness for societal impact of science and technology (Miller, 1983). Better information improves the image of science in society and makes public debates on science more informed (CS10). Science literacy and science education increases the numbers of competent students and researchers qualified to conduct science (CS04).

Table 4: Potential benefits in Gender Equality

Democratic	Economic	Societal	Science
Higher numbers of female researchers and female researchers in leading positions in R&I are an intrinsic democratic benefit (CS04, CS17, CS18). Considering the needs of the entire population will have effects on policy-making at national and EU levels (CS19).	Involving different perspectives increases the quality of R&I and therefore improves products and company performance (EC, 2013; Catalyst, 2014; CS03, CS15, CS17, CS19). Products (e.g. medicinal products) that match better with every part of society save costs and create new markets (CS17, CS19). Includes untapped human resources and creates a more diverse workforce (Gilmer et al., 2014; CS06).	To increase the share of female researchers and female researchers in leading positions in R&I is an intrinsic societal benefit and counters stereotypes (CS04, CS06, CS17, CS18). Society benefits from better-targeted and diverse research and products for all of the population which has positive effects on different fields of society, e.g. in health (EC, 2013; CS17, CS19).	Diverse and inclusive scientific workforce is a benefit in itself (Gilmer et al., 2014; CS04, CS06, CS17, CS18, CS19). Inclusion and diversity of researchers, teams, organisations, topics, and analysis lead to higher research quality and excellence (EC, 2013; Lipinsky, 2014; CS06, CS17, CS19). New gender-aware curricula are developed (CS19).

Table 5: Potential benefits of RRI in Ethics and Governance

Democratic	Economic	Societal	Science
Existing democratic institutions are strengthened or new ones are established (CS01). Instalment of new and transparent institutional practices clarifying critical issues (CS05).	Litigation costs are saved because research misconduct is prevented and conflicts mediated early (CS08). Economic success also depends on fulfilling clients' demands related to RRI. Compliance avoids potential business losses (CS15). RRI and ethics is perceived as inherent to the business purpose (e.g. products which use less energy and are sustainable)and has not to be justified by numbers (CS16) Addressing RRI issues and forming for that purpose new and broader networks can result in new clients/contracts (CS14). Development of new business cases and ideas (CS14). Saved costs because of risk assessments or sustainability assessment (CS14, CS15, CS16).	Trust building and facilitation of communication between different actor groups (scientists, policy makers, stakeholders) through ethics activities (CS01). Safer and more sustainable research and development that reduces negative externalities, e.g. by reducing negative effects on society and negative impacts on the environment (CS15, CS16).	Reputational gain and increase in trust in science and research (CS05, CS08, CS10). Increased funding chances because of improved reputation of scientific institutions and new funding opportunities (CS07, CS08). Change in scientific culture and new institutional processes (CS07, CS08). Early-career researchers benefit from more open and transparent scientific culture (CS09).

Table 6: Potential benefits in Open Access

Democratic	**Economic**	**Societal**	**Science**
No democratic effects of Open Access were identified in the conducted case studies, but it can be assumed that the democratic process, stakeholders, and policy-makers can also benefit from publicly available data and research, especially regarding information in decision-	Sharing results, data, and knowledge can stimulate innovation and increase transparency (Dallmeier-Tiessen et al., 2011; Costas, 2013; Davies, 2013; CS20). New patents (C20). New funding opportunities (CS16).	No societal benefits were identified in the conducted case studies, but it can be assumed that society benefits from the access to data and research, that is also often funded by tax money.	Sharing results, data, and knowledge can advance research and innovation (Costas, 2013; Dallmeier-Tiessen et al., 2011; Davies, 2013). Higher visibility and recognition of scientists as authors and new publication opportunities (Dallmeier-Tiessen et

making processes.	Timesavings from use of existing open data (greater efficiency) (CS20). Return of investment in R&D (CS20).		al., 2011; CS20). New patents (CS20). Open Access to data and knowledge benefits early-career researchers and young scientists (CS09).

Table 7: Potential benefits of RRI suggested in the Visioning Exercise[5]

Democratic	Economic	Societal	Science
Reduction of inequality. Increased trust of society in policymaking. Reduction of R&I related conflicts; increase of trust in science and innovation. Increasing number of productive interaction in R&I policy-making (productive interaction framework). Increase of interest in/attractiveness of policies.	Increased job satisfaction/ motivation (policy-makers, innovators, researchers in both academia and industry). Better effectiveness of public investment in R&I. More innovation. More high-tech innovation (provides competitive advantage). More start-ups in high-tech sectors. Higher revenues (due to potentially better qualified and motivated employees). More long-term investments. Higher mobility of workforce. Enhanced qualification levels.	Increase in contribution of R&I to societal progress. More companies receiving rewards for responsible conduct (e.g. environmental, social, ethical). Research contribution to environmental benefits. More lifelong learning.	Increasing interest in science.

[5] See Kukk, P., Lindner, R., Warnke, Ph. (2015). Monitoring the Evolution and Benefits of Responsible Research and Innovation. Progress Report D5.1. Update of the literature review (Sub-task 6.1) & Visioning exercise (Sub-task 6.2). European Commission.

3 Preliminary assessment on the availability of quantitative and qualitative empirical evidence on the benefits of RRI

One objective of the MoRRI project is to assess the availability and quality of quantitative and qualitative empirical evidence of RRI activities and their impacts. Therefore, critical reflection of the data basis of each case study was an integral part of the analysis in Task 6, and especially in the comprehensive case study programme (Sub-task 6.4), both in selecting the case studies as well as in the analysis and interpretation of the collected data.

This chapter focuses on the availability and significance of data on the benefits of RRI as well as on its limitations and challenges. First, we elaborate on the availability and quality of data in the first round of case studies, which screened and analysed available material and results from European research projects on RRI related issues.[6] The following sections provide findings on data availability from the second and third round, in which consortium members conducted original case studies.

3.1 First round of case studies

3.1.1 Research process and data

The first round of the case study programme screened 67 completed and ongoing EU-funded projects on RRI or on individual RRI dimensions (see Annex II). The scope of analysis included research focus, topic, RRI dimensions, as well as the data produced and analysed.

In a next step, several projects were selected for further analysis; for that, projects were selected that conducted empirical research and tried to collect, measure, and analyse the effects and impacts of RRI activities. This included projects that applied quantitative and/or qualitative approaches. Projects were excluded from further analysis if they lacked empirical evidence or if their results did not establish reliable links between the RRI measures and their impacts. After screening 67 projects, 14 remained as eligible for case studies.[7]

In a subsequent step, these 14 cases were reviewed in-depth: publications and other output material was collected and analysed in detail regarding the suitability as case study. Out of these 14, seven projects were considered as suitable because data quality, analysis, and presentation of results was sufficient.

In a final step, the IHS selected four cases and - using a formalised template - analysed them about the benefits of RRI.

3.1.2 Results

The review of existing EU-funded projects showed that many dealt with one or several of the RRI dimensions. Some projects carried out certain RRI activities, e.g. Open Access or Gender Equality measures. Others did empirical research on certain aspects and/or put forward normative frameworks or recommendations to support changes at the political, institutional, or individual level. However, there were also projects combining an active approach with empirical investigation. Since the concept of RRI is relatively new, only few projects tried to deal with it in a holistic way, thus did not reduce RRI to one or two of its dimensions. The majority of projects were concerned with single RRI dimensions.

3.1.3 Note on data availability

The first round of case studies, especially the screening and selection process, revealed several problems concerning availability of quantitative and qualitative empirical evidence on the benefits of

[6] Annex II provides additional information on these projects.

[7] See Wuketich, M., Lang, A., Griessler, E. (2015). Monitoring the Evolution and Benefits of Responsible Research and Innovation. Progress Report D5.2. In-depth case studies of the scientific disciplines and industrial sectors. European Commission.

RRI. Although there is a diversity of European projects and activities dealing with RRI or certain RRI dimensions, there is a lack of empirical assessment of the social, economic, and democratic impacts of these RRI activities. This has several reasons:

- Some projects did not have the objective of evaluating the effects or impacts of the RRI activities and thus did not analyse them. For example, coordination and support actions or network projects often did not plan on comprehensive and systematic empirical data collection or analysis and did not evaluate in-depth the effects and impacts of their own RRI related activities (see Annex II, e.g. projects no. 01, 08, 09, 14, 30, 35).
- In some cases, the lack of evaluation can be attributed to the duration of the projects. Projects lasting two or three years can hardly assess the wider impacts of RRI activities empirically, because those need time to unfold.
- Some empirical research projects, although they collected and analysed data on RRI measures or activities, did not analyse the effects and impacts of these activities but were rather descriptive in their analysis (see Annex II, Table 14, e.g. projects no. 02, 06, 07).
- At the time of the screening, several projects were still ongoing or had just started. Thus, they had not produced evidence on the impacts of RRI activities yet; this is especially true for European projects explicitly dealing with the topic of RRI (see Annex II, Table 14, e.g. projects no. 56, 58, 59, 61, 62, 63, 64, 65, 66).
- For some projects dating far back, it was hard or not possible to find or retrieve the output material (project reports, journal articles). The projects' web pages were offline, the CORDIS database only gave few information and short summary reports, and the project coordinators could not be contacted or could not provide any material. Therefore, it was impossible to evaluate their suitability as a case study.

Scanning the 14 pre-selected projects as well as the in-depth analysis of the four selected case studies revealed additional challenges regarding the availability of appropriate data on the benefits of RRI.

3.2 Second and third round of case studies

3.2.1 Research process and data

In the second round of case studies, the consortium partners designed and carried out new empirical case studies, trying to find impacts and benefits of activities that could be related to RRI or certain RRI dimensions. In order to gain a diverse insight into different dimensions and areas of impact, the expertise of the dimension leaders was tapped and consortium partners were asked to suggest cases. Out of those suggestions, a list of case studies was selected that

- built on the results and conclusions of the first round of case studies,
- took account of the indicated gaps in the coverage of fields of benefit and RRI dimensions,
- considered the availability of and access to data as stated by the consortium partners,
- and therefore assessed the viability to conduct the case studies in the scope of the MoRRI project.

The third round continued and extended this approach. Consortium partners investigated further cases, trying to fill existing gaps in the coverage of RRI dimensions, fields of benefits, and R&I institutions. The consortium partners focussed on finding economic benefits of RRI activities, since those were only marginally identified in the second round.

Most case studies relied on desk research and qualitative interviews with relevant stakeholders and actors involved in the implementation of RRI activities at different levels and institutions. Desk research used material provided by the researched organisations or projects, including annual or monitoring reports, evaluation reports of organisations or activities, online material, and other diverse output material. The interviews provided a deeper insight into the implementation of RRI activities and measures. Case studies often depended on the pre-existence and availability of data, thus data that was continuously collected, monitored, and evaluated by the respective institutions and actors in focus of the case study, e.g. the output and impacts of certain activities promoting RRI.

3.2.2 Results

MoRRI case study researchers found clear evidence and trends of RRI benefits. In the second round, mostly democratic and societal benefits were identified. Economic benefits were recognised as well and mostly assessed and identified based on qualitative data. The case studies investigated different institutions and societal actors that implemented various RRI measures, which consequently resulted in a variety of (possible) benefits.

RRI activities ranged from policy and strategy processes related to certain dimensions or an overall RRI approach, to very specific and targeted measures in one of the RRI dimensions. Especially Gender Equality and Open Access measures were well assessed, therefore it was possible to identify specific benefits – and some possible indicators.

Because of the identified gaps in the previous rounds, the third round focused on identifying economic benefits of RRI activities. These case studies showed some quantifiable economic benefits of certain RRI dimensions. These positive effects of RRI were mostly based on qualitative data or statements by interview partners.

3.2.3 Note on data availability

The difficulties and limitations in the first round of case studies to empirically measure impacts and benefits, and to identify causalities between RRI measures and impacts or benefits continued in the two subsequent rounds due to:

- **A lack of available baseline and evaluation data:** The scope and timeframe of the case study programme did not allow for comprehensive empirical data collection, but had to rely on existing evaluation data or evidence given in expert interviews with representatives of the investigated institutions and organisations.
- **Data accessibility:** This can be an issue when company or research data is inaccessible for various reasons (privacy, data security, fear of competition). Baseline data was often not collected before the implementation of RRI activities and thus the identification of the impacts of an activity was very difficult. Generally, there is a lack of existing evaluation of implemented RRI activities.
- **The often short implementation span of RRI measures:** (Long-term) benefits and impacts cannot yet be measured or can only be identified in trends, since many of the RRI measures were only implemented recently.
- **Difficulties of directly attributing benefits to RRI activities:** The direct link of RRI activities and outcome benefits is hard to establish. Primary data tracking the effects of RRI measures was hardly available and could not be generated in the limited time available for conducting the case studies.

Case study investigators mostly used existing data about RRI activities and their outcomes, especially (quantitative) monitoring or evaluation data. This data was very diverse in its value, depth, and quality. Some had comprehensive evaluation reports at hand that aimed to assess the impacts and benefits of the undertaken RRI activities and thus were very suitable for the case studies and their goal of identifying possible benefits. Some gathered lists of different outputs and results of RRI activities, especially when these activities were projects. Outcome and benefits of their respective undertaken RRI activities were identified by interview partners based on their experience and insight, but they were often not based on systematically collected and comprehensive empirical (quantitative) data.

These challenges should be addressed in further research on the impacts and benefits of RRI.

3.3 Identification of the logical link between RRI dimensions and applicable benefits

Deliverables 5.1 and 5.2 provide evidence of many potential benefits of RRI (see also

Table 2 to Table 7). However, a basic problem that all empirical research faces, particularly social science, is that it is challenging (and sometimes impossible) to generate comprehensive and reliable data on causalities between a certain "input" – in this case a RRI activity or measure – and an "output" or "impact". The case studies investigated the implementation processes and effects of certain measures in real-life settings and not in a controlled environment (experimental setting). Thus, it was not possible to attribute changes in the respective areas to certain measures or activities. Even in a controlled setting, it is hard or even next to impossible to claim 'proof' of causation – unless there are several overlapping studies using different kinds of evidence. This challenge has to be borne in mind when trying to find benefits of RRI.

To establish a clear causal link between "input" of various RRI activities and "output" or "outcome", i.e. the benefits and impacts derived from these activities, proved to be challenging for several methodological and practical reasons.

First, causalities between RRI activities and impacts were often identified based on insecure and not systematically collected data, e.g. on the assessments made by involved actors or affected stakeholders or anecdotal evidence. Few comprehensive and systematic empirical assessments were carried out.

Second, if wider mid- and long-term effects were claimed, these were based on uncertain future prognoses.

Moreover, it is difficult to measure the impact of many RRI activities because of their comprehensive and qualitative nature. In order to identify benefits, it seems to be most viable to assess very specific targeted RRI measures that can be traced easily and whose possible benefits can be ascribed directly, rather than looking at broad initiatives that include many activities, where linking specific benefits to specific RRI measures is harder. This is easier when it comes to certain dimensions like Gender Equality or Open Access, but harder when it comes to more general or conceptual dimensions like Governance or Ethics. The same applies to the fields of benefits. In general, it is easier to find democratic and social benefits of RRI, but the causal link is more difficult to establish in these cases. It is harder to find specific economic benefits that are based on concrete numbers; nonetheless, they could then be quite reliably linked to RRI activities if those are very specific and targeted (see also next chapter). For the identification of broader economic benefits, the same limitations exist as for democratic and social ones.

In addition, in order to prove a causal link between activity and impact it would be necessary to design empirical studies that monitor RRI activities and their long-term impacts from the start. For example, in order to assess the impact of a training programme, it is the second best solution to base the evaluation on participants' self-assessment. It would be preferable to carry out long-term monitoring of the way in which the course affects the participants' thinking, work processes, and actions. Only such an approach can identify and establish the logical link between activity and benefit. It became apparent during the project that it is difficult to prove and quantify such causal links without baseline data. Conducting such comprehensive long-term case studies was impossible within the practical limitations of the project. The case studies therefore had to be based on already existing data, which was either collected by the organisations carrying out the RRI activities or by researchers they contracted.

Another difficulty is related to the fact that in some cases the evaluation and assessment of implemented RRI activities was still ongoing. Conclusions from these studies were therefore not yet available. Keeping track of those evaluations and studies could lead to a more valuable identification of causal links and possible benefits of RRI activities, since the organisations conducting the RRI activities themselves are collecting the data and are interested in following those developments.

Due to these difficulties, the indications of causality between RRI activities and impacts in many cases draw on limited and/or unsystematically collected data, anecdotal evidence from expert interviews, self-assessment by involved stakeholders, or qualified assessments by the case study researchers of the MoRRI consortium.

Nevertheless, the case study programme showed links between RRI measures and ascribed benefits. (see

Table 2 to Table 7).Though, evidence for the benefits of RRI can and should be approved in the future, Task 6 of the MoRRI project provided evidence from various case studies for the different benefits of RRI for science, society, economy and the political system.

4 Estimating the Economic Effects of RRI – a summary of the experiences from the case studies

In this chapter, we briefly summarise the experiences from the case studies of the second and third round with respect to the identification, conceptualisation, and measurement of economic effects of activities in the different dimensions of RRI with a view to lessons learned for the next phase of the project. It has to be pointed out that the case studies so far were only able to provide a quite scattered and far from complete picture of these effects, even though in the third round a few enterprises were included to compensate for this gap, which was already apparent in the second round.

The majority of case study reports concluded that:

- The economic effects are too difficult to measure, because the economic dimension is *not seen as an important one* for the respective RRI dimension (e.g. in questions concerning the ethical conduct of research and the related activities carried out by the Austrian Agency for Research Integrity OeAWI) and is therefore not thought of or measured.[8] Very often, the economic dimension is not given much thought because RRI related activities are seen as "good-in-themselves".
- Furthermore, the effects *cannot be easily attributed* to the activity or measure – e.g. in the case of educational programmes or gender-/diversity-related activities, where effects on individual careers (which could be measured in economic terms by looking at income differences or the ability to generate research income between those taking part and those not taking part) take considerable time to materialise and are subject to numerous influences which makes it hard to single out the influence of the specific RRI activity (e.g. of female research participation or the ethical conduct of research). Hence, in almost half of the case studies, economic benefits were not identified in any form. A few case studies suggested non-monetary (physical) or monetary indicators to measure the economic benefits identified. Only in three cases it was attempted to calculate economic benefits of RRI (see below).
- Even where measurement would be possible in principle, the data basis available to the MoRRI consortium is weak because the required data was not monitored and collected by the responsible institutions (at least not on a regular basis) and hence no quantitative assessment could be conducted. Some case studies were able to provide ideas of how and where measures could be developed in the future, provided this data was gathered. An example is the case study about the Dutch Nanotechnology RRI initiative, which identifies indicators of economic effects like the number of business case developments, business start-ups, patents applied for, and so on. Another example is the Participatory Action Research (PAR) in environmental management, which would have lent itself rather easily to economic assessment, but this was not performed or recorded by the initial researchers and thus data was not available to the MoRRI consortium. Indicators were proposed, e.g. by the achieved improvements of land vulnerability. These are or could have been at least good proxies for economic impacts (though not tantamount to economic impacts in a strict sense). In a lot of cases though, the case study reports revert to formulations like "(…) seems to have increased (…)", "(…) effects are purely speculative at this stage (…)", or that anecdotal evidence "(…) suggests (…) that there are spill-over effects (…)", or that "(…) economic impacts are seen as likely, but have not been quantified (…)", which is an indication for the difficulties encountered in actually nailing down the economic effects.
- Quite often – interestingly also in the case of the enterprises that were subject of case studies – outputs and outcomes were identified and recorded, but not given *economic* values. Rather, effects were more often reported in *physical* terms (e.g. reduction of CO_2 emission, energy savings, improvements of environmental variables, and the like). In the case of enterprises (e.g. AVL and Infineon), this has to be noticed both with respect to the internal efficiency measurement as well as to the (promised) external effects to the customers. Indicators put forward include health and workplace security for employees in terms of injury rates or sick leave days, or environmental effects like water or energy consumption and waste generation.

[8] Admittedly, the economic dimension was not equally addressed in all case study interviews with the same vigour.

Apparently, these figures are easier to come by than economic valuations, but they also provide a basis and a starting point for economic valuations proper.

- There were also some *semantic/conceptual barriers*[9] encountered in the course of the case studies: mostly, it was not possible to directly address the question of effects of RRI, as most actors do not think of or label their activities in this frame. For example, enterprises like AVL and Infineon quite often use notions relating to the concept of "Corporate Social Responsibility" (CSR), which is well established among enterprises. In the same vein, the Research Council of Norway (RCN) and its RRI activities, subject of one of the case studies, was an example of such conceptual ambiguities. The case study on research integrity and Open Access activities of EMBO also points in the same direction: quite often different labels are used for activities recently characterised as RRI dimensions. This non-familiarity with the concept of RRI should make cautious regarding research designs and policy debates, which could too easily presuppose a general acceptance and sharing of the meaning.
- Finally, even where economic effects were recorded, the attention was tilted towards the benefits. However, these effects also include *costs* (in terms of awareness, time, and personal resources allocated to them). There are just a few case studies that were able to provide estimates of cost, and if they did, they were direct costs of funding for the activity where external funding was provided. The sole exception was a (subjective) cost-benefit assessment in the case of the Dutch Nanotechnology study, where it was pointed to the fact that – at the level of the individual or at the level of a small company, which cannot reap the benefits occurring as externalities of the Nanopodium Programme – the cost-benefit relation appeared to be negative. High costs were also observed in the case study on OPAL, pointing to the complex process and the administrative requirements of "Citizen Science" approaches. In future studies, more attention should be given to this dimension of economic effects in any case, as well as to the practical implementation of RRI activities, as this is the easier part of identifying economic effects, whereas the identification of benefits is much more elusive

Despite these limitations, at least a few observations could be made of (1) existing good practice (e.g. the EMBL-EBI case), (2) of the potential to construct meaningful indicators reflecting economic effects in the future (e.g. Gender Medicine at the teaching hospital Charité in Berlin, Germany, or the valorisation programme of the Nanotechnology RRI in the Netherlands).

- A case of *existing good practice* is the estimation of economic effects of the open data activities of the EMBL-EBI. In this case, a thoroughly designed study covers various layers (investment and use value, contingent valuation (by means of estimates of willingness-to-accept and willingness-to-pay), efficiency impacts (savings over time), and Return-on-Investment (RoI) on the use of the services. Thorough approaches like this one come closest to what one could hope for in the assessment of the economic benefits of RRI. What remains doubtful though (and the case study rightly points to this caveat) is whether this assessment could equally be applied to other areas of activities of the EMBL-EBI. This warning is consistent with the observation that measures of economic effects can – to a different degree – be applied to the different dimensions of RRI, hence might not be able to capture all respective activities of an organisation.

  The *potential to construct meaningful indicators* reflecting economic effects could be seen in cases like the efforts to establish responsible conduct (in our case at Aarhus University). It could be possible to establish more sound measures of the economic effects of ethical research. This could be in the form of reputational gains (or losses) for the individual as well as for the institution, which might be monetised (e.g. in the form of higher success rates of projects and better career advancement), but would require in-depth, longitudinal studies on a large number of cases. As this would go beyond the means of individual institutions in most cases, studies that could be the basis for such estimates should be provided at the national and international level. Some case studies also came up with proposals for indictors that were not yet applied. These proposals deserve closer scrutiny, as some of them might lead to an empirical basis for the estimation of economic effects beyond the narrow confines of the respective RRI dimension. For example, in the case of the UK Science Media Centre (SMC), the

[9] This remark is not confined to the analysis of the economic effects, but may be pertinent for all aspects of RRI analysis.

effort was sufficiently large to give rise to the expectation that it might have influenced public understanding and acceptance of science on a large scale. If this were true, the proposed indicator (increased competitiveness through the establishment – or the ease of establishment – of "lead markets") might make sense. Likewise, the scale of the initiative of the Open Air Laboratories (OPAL) was so large, that several measures could have been applied to establish its economic effects (cost savings in data collection through citizen participation as compared to traditional coverage of territories, improvements of methodologies and direct environmental improvements, and the like). Alas, such data was unavailable.

The following table gives an overview of the economic benefits identified in the case studies:

Table 8: Legend

Legend	
Fulfilled	
Partly fulfilled	
Tried, but not successful	

Table 9: Overview of identified economic benefits in the case studies

Case Study	**Economic benefits identified**	**Non-monetary indicators suggested**	**Monetary measurement suggested**	**Economic benefits calculated (in €)**
CS01				
CS02				
CS03				
CS04				
CS05				
CS06				
CS07				
CS08				
CS09				
CS10				
CS11				
CS12				
CS13				
CS14				
CS15				
CS16				
CS17				
CS18				
CS19				
CS20				
CS21				

As an attempt to synthesise the findings, one could conclude that:

- Generally, more efforts could be made to systematically capture the economic dimension. This is still a gap in the current analysis of RRI.
- There is a potential for further development of indicators potentially depicting economic effects, but this potential is different for the individual dimensions of RRI – particularly the ethical and participatory dimension are probably most challenging in this respect.
- In some cases, e.g. with respect to Gender Equality and Open Access, some measures already exist that could be more widely put to use and that could serve as good practice examples. Some of the case studies give indications in this direction.
- It also became apparent that we still lack a comprehensive set of operationalisations for the potential economic benefits of the various dimensions of RRI. Building on the work we did in the first phase of the project, and taking into account the examples of the case studies (as scattered as they might be), we will strive to provide such an operationalisation at the end of the project.

Next steps in the analysis of economic benefits of RRI

If one wants to take the analysis of the economic benefits of RRI in the context of this project further, what is needed is: (1) further elaboration of categorisations that would be able to capture potential benefits, (2) respective indicators, and (3) assessment methods. In this vein, the development of a "toolbox" is suggested: This toolbox contains methods and indicators for the analysis of economic effects of RRI.[10] The toolbox can be based on (1) the existing case studies, and (2) a literature review of methods and indicators used in other fields (e.g. Social Impact Measurement, Environmental Evaluation, etc.).

A broad variety of methods for calculating the monetary value of benefits in other research fields already exists (e.g. Corporate Social Responsibility, Environmental Evaluation, Social Impact Measurement, Gender Studies). Based on a literature review, the following methods seem applicable for the calculation of the monetary value of benefits of RRI:

[10] A role model for such a toolbox can be found in "European Commission: RTD Evaluation Tool Box" (see especially Polt and Woitech, 2002).

Table 10: Methods for calculating the monetary value of benefits of RRI

Direct market valuation approaches	Revealed preference approaches	Stated preference approaches

• Market price-based approaches
• Cost-based approaches
  ○ Avoided cost method
  ○ Opportunity cost method
  ○ Replacement cost method
  ○ Mitigation or restoration costs
• Approaches based on production functions
	• Travel cost method
	• Hedonic pricing
		• Contingent valuation method: Willingness to Pay (WTP) or Willingness to Accept (WTA)
		• Choice modelling
		• Group valuation

(Dlamini, 2012; Maas and Liket, 2011; Pascual et al., 2010; Pearce et al., 2006)

Using methods and indicators which already exist – even though in other research fields – show that there is potential to take into account the existing case studies further and to identify which measures of (economic) benefits of RRI in monetary terms could have been applied. To illustrate this approach, Case Study 15 and Case Study 19 are taken and the existing information is extended with suggestions based on a literature review (extensions are shaded in grey).

Table 11: Case 15 – CSR measures (extensions marked in grey)

Benefit	Measurement (non-monetary)	Measurement (monetary) – Individual research entity	Measurement (monetary) – Society
Less water needed for production	Water consumption: Difference in water consumption before and after the CSR measure	Cost savings (water price per m^3 * water saved in m^3)	
Less waste	Waste generated in tons: Difference in waste generated before and after the CSR measure	Cost savings (cost for waste disposal * avoided waste)	
Lower energy consumption	Energy consumption: Difference in energy consumed before and after the CSR measure	Cost savings (electricity costs per kWh * kWh saved)	
CO_2 savings	CO_2 saved	Cost savings (based on the costs for CO_2 allowances within the EU emissions trading system)	Costs saved for CO_2 mitigation (e.g. through afforestation)

Table 12: Case 19 – Research Group on gender medicine (extensions marked in grey)

Benefit	Measurement (non-monetary)	Measurement (monetary) – Individual research entity	Measurement (monetary) – Society
New medications/ treatments	Number of new medications/treatments	Value of sales of new medications/treatments	Employment resulting from research-informed product development; Direct cost savings to the health-care system based on a reduction of costs of treatment per patient; Savings in non-medical direct costs (custodial care, transportation, etc.)
Better life expectancy	Life expectancy	Individuals willingness to pay for reductions in the risk of death	
Benefits to the economy from a healthy workforce	Avoided days of sick leave		Savings from avoided lost production or avoided costs due to sick leave

To sum up, the identification of economic benefits and their measurement is a difficult but not impossible undertaking. To lay a theoretical and conceptual foundation for future attempts to measure economic benefits of RRI, it would be an effective measure to develop a "toolbox" and make it available to those carrying out RRI activities or evaluations of it. With suitable methods (from other areas of application) and indicators at hand, data collection and the identification of potential economic benefits of RRI could thus be made possible/easier in future assessments. In the context of the MoRRI project, we will strive to elaborate such a toolbox. This would lay the conceptual basis for empirical work in the vein, but beyond MoRRI.

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Annex I: MoRRI Case Study Overview

Table 13: MoRRI Case Study Overview

No	Case	RRI Dimension	R&T field	Area of impact			
01	Bridging the gap between science, stakeholders and policymakers. Phase 2: Integration of evidence-based knowledge and its application to science and management of fisheries and the marine environment (GAP2)	• Public Engagement	Aquaculture	Dem	Eco	Soc	
02	Impact of Citizen Participation on Decision-Making in a Knowledge Intensive Policy Field (CIT-PART)	• Public Engagement • Ethics and Governance	Biotechnology, Medicine	Dem		Soc	Sci
03	Women in Innovation, Science and Technology working group (WiST)	• Gender Equality	Natural Science and Engineering		Eco	Soc	
04	Promoting inquiry in mathematics and science education across Europe (PRIMAS)	• Science Literacy and Science Education	Mathematics		Eco	Soc	Sci
05	Institutional Efforts to Ensure and Enhance Responsible Conduct of Research: Lessons Learned from Aarhus University	• Ethics and Governance	All disciplines			Soc	Sci
06	Gender and affirmative action: Lessons Learned from the Danish Council for Independent Research (YDUN)	• Ethics and Governance • Gender Equality	All disciplines			Soc	
07	Research Council of Norway	• Ethics and Governance • Gender Equality • Open Access	All disciplines			Soc	
08	Austrian Agency for Research Integrity	• Ethics	All disciplines	Dem		Soc	Sci
09	European Molecular Biology Organization (EMBO)	• Ethics and Governance • Open Access	Molecular Biology				Sci
10	UK Science Media Centre	• Public Engagement	Natural and Physical	Dem	Eco	Soc	Sci

No	Case	RRI Dimension	R&T field	Area of impact			
		• Science Literacy and Science Education	Sciences, Engineering				
11	Open Air Laboratories (OPAL)	• Public Engagement	Environment Studies	Dem		Soc	Sci
12	National Open Access Policy in the Netherlands	• Ethics and Governance • Open Access	All disciplines	n/a	n/a	n/a	n/a
13	Participatory Action Research (PAR) in Environmental Management	• Public Engagement • Ethics and Governance • Science Literacy and Science Education	Environmental and Land Management	Dem	Eco	Soc	Sci
14	Nanotechnology RRI in the Netherlands	• Public Engagement • Ethics and Governance	Nanotechnology		Eco		
15	Infineon Technologies Austria AG	• Ethics and Governance • Gender Equality • Open Access	Semiconductor and System Solutions			Soc	
16	AVL List	• Ethics and Governance • Gender Equality • Open Access	Powertrain Systems			Soc	
17	FemPower Bonus for Female Project Leaders	• Gender Equality	ICT, Life Sciences	Dem	Eco	Soc	Sci
18	Gender Criteria of the Austrian Science Fund (FWF)	• Gender Equality	All disciplines	Dem		Soc	Sci
19	Institute of Gender in Medicine at the Charité University Medicine Berlin	• Gender Equality	Medicine	Dem	Eco	Soc	
20	The European Bioinformatics Institute (EMBL-EBI)	• Open Access	Molecular Biology		Eco		
21	ETH Zürich	• Public Engagement • Science Literacy	All disciplines	n/a	n/a	n/a	n/a

No	Case	RRI Dimension	R&T field	Area of impact			
		and Science Education					

Annex II: Screened EU projects (first round of case studies)

Table 14: 67 projects screened in the first round

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
01	SET-ROUTES	Pan-European women ambassador programme bringing female role models to schools and universities to stimulate and mobilise girls and young women for studies and careers in SET.	No	It is a networking/ambassador programme that does not have the purpose of assessing the wider impact of its activities on R&I. In general, impacts of such programmes are hard to assess (e.g. long-term effects on scientific awareness or career paths).	GE
02	SHE FIGURES	Statistics and Indicators on Gender Equality in Science.	No	The project offers data and analysis regarding the number, distribution and situation of women in science and research, but it does not analyse the impact (effects/benefits) of Gender In-/Equality on R&I per se.	GE
03	WiST	Women in Innovation, Science and Technology working group.	Yes	WiST conducted several in-depth studies working together with industry partners. Thereby, it was a platform to promote gender diversity in science and technology areas within business and industry (and in a later round: higher education institutions (HEIs)). On the one hand, it analysed the representation of women in different areas of and positions in R&D in business, industry, and HEIs. On the other hand, it also analysed certain effects, including benefits, of gender diversity in R&D. For example, an analysis was conducted that used econometric modelling to show how research performance is affected by gender diversity in R&D teams.[11]	GE
04	EPWS	European Platform of Women Scientists	Possibly	The EPWS is a network of networks that tries to bring together and start exchange between different national/international organisations with the purpose of promoting women in science. Currently it works on a voluntary basis. Its activities	GE

[11] Turner, L. (2009). Gender Diversity and Performance. *International Journal of Innovation and Sustainable Development, 4*(2/3), 123–134.

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
				range from the organisation of conferences to statistical analyses of the representation of women in R&D to networking means. It also collects different studies and data regarding women in science. The given empirical evidences and analyses seem to focus on the representation of women and on measures/policies to promote women in science, but a closer look at the individual studies and results might reveal analyses of impacts in different areas.	
05	WHIST	Women's careers hitting the target: gender management in scientific and technological research.	No	WHIST conducted pilot experiments with a participatory approach to promote gender diversity in three scientific organisations. These experiments were monitored and evaluated. It was analysed "how and under what conditions" certain measures to promote women in science can have an impact on gender diversity. Based on the results, WHIST also produced guidelines on gender diversity in science and technology organisations. In WHIST, the impacts of certain gender diversity measures on gender equality were measured. Thus, it might be a case that illustrates the democratic impact of RRI measures (Gender).[12]	GE, PE
06	TANDEMplusIDEA	Establishment of an international strategic development between leading European technical universities with the aim of increasing the number of female professors in natural science and engineering.	Yes	"The […] objective of the project was to increase the number of female professors by supporting the careers of a number of high potential young female scientists […]" (Technopolis, 2012, p. 18)[13]. Besides conceptualisation and implementation of a mentoring programme, an evaluation of its impact was conducted. Effects of the programme on the participants' career paths and other related issues are described.	GE

[12] WHIST (2011). Guidelines on Gender Diversity in S&T Organisations. Retrieved 10 March 2015, from http://www.reteparioppportunita.it/Rete_Pari_Opportunita/UserFiles/whist/whist_gl_def_ok_28112011.pdf. Further material: http://cordis.europa.eu/project/rcn/91101_en.html

[13] Technopolis Group (2012). SiS Case Studies compiled.

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
		(Coordination Action)		Although such programmes tend to have long-term effects, there are first indicators in the projects evaluation. The project also produced a model of good practice. Positive effects on women's careers in science and more Gender Equality in this area could be seen in social and democratic terms. Thus, including this project as a case might reveal benefits of RRI in this respect.[14]	
07	SHEMERA	Euro-Mediterranean research cooperation on gender and science: SHE Euro-Mediterranean Research Area.	No	The objective of the project is to collect data and existing statistics on women in science in Mediterranean countries (similar to SHE-FIGURES). Furthermore, it tried to create a network of stakeholders involved in women and science activities and policy-making. The project does not primarily focus on the impact that certain factors have, but is rather descriptive.	GE
08	TWIST	Towards Women in Science and Technology.	No	TWIST was a support action that designed and implemented various activities and exhibitions in science centres. It tried to draw attention to gender stereotypes and challenge them. Thus, interest of girls in science and research should be furthered. The project produced different guidelines for science centres and museums as well as school teachers, conducted gender days (in science centres and museums), an interactive exhibition, and an online test to self-assess gender bias towards science and research. TWIST did not examine or evaluate the impact of their measures on research and innovation or in other areas.	GE
09	GENIS LAB	The Gender in Science and Technology LAB.	No	GENIS LAB is a support action that tries to improve the working conditions and career opportunities of women in science and research by implementing certain organisational tools to raise gender awareness (in six institutions).	GE

[14] TANDEMplusIDEA (2010). *Final Report*.; Leicht-Scholten, C., Breuer, E., Tulodetzki, N., & Wolffram, A. (Eds.) (2011). *Going Diverse: Innovative Answers to Future Challenges. Gender and Diversity Perspectives in Science, Technology and Business*. Opladen: Budrich UniPress.

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
10	GENSET	Increasing Capacity for Implementing Gender Action Plans in Science.	Possibly	GenSET was a support action that wanted to "raise awareness and build capacities for the incorporation of gender knowledge and gender mainstreaming expertise into science institutions" (Technopolis, 2012, p. 31). Furthermore, it wanted to "propose a new understanding of the impact of the gender dimension on the quality of research" (ibid.). Although the project produced "large-scale outputs" in terms of involvement of different stakeholders and science institutions, agreement to a memorandum of understanding by many stakeholders, facilitation of dialogue, etc., it does not produce evidence on the impact of gender measures on RI. This project might be a starting point for a new case study to assess the effect of the measures taken by different institutions.	GE
11	PRESCIENT	Privacy and emerging technologies.	No	The project dealt with privacy and ethical issues of emerging technologies. It redefined the concept of privacy and made five case studies on ethical and social aspects of different new technologies (RFID, biometrics, genome sequencing, human enhancement, new surveillance technologies) with regards to privacy. The cases identify and discuss different privacy issues and the legal framework in place to deal with them. The project then developed an assessment method for privacy and ethical issues of emerging technologies. The impact of the project efforts, results or the effects of an implementation of the proposed framework are not monitored or evaluated. In addition, the case studies do not provide empirical evidence for the benefits of RRI considerations into the innovation process.	ET
12	EPOCH	Ethics in Public Policy Making: The Case of Human Enhancement.	No	The EPOCH project investigated the role of ethics in the governance of science and technology with a focus on human enhancement. It developed strategic recommendations for dealing with normative issues of technologies and innovation, but no evaluation of its impact has been done. Thus, it is not suitable as case for further examination.	ET

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
13	ETHICSWEB	Inter-connected European Information and Documentation System for Ethics and Science: European Ethics Documentation Centre.	No	The project's objective was to build a database that contains information on ethics and science (literature, laws, regulations, projects, events, news, etc.). This should foster information and engagement of the public and initiate public debate. There is no information whether or not this goal could be accomplished or on the positive effects of this project on R&I in general.	ET
14	EURECNET	European Research Ethics Committees Network.	No	EURECNET built the infrastructure for a network of research ethics committees (REC) across Europe. They wanted to promote awareness of the different practices, mutual exchange between these committees, and to collect and evaluate existing training materials for REC members. The project was not a research project. There is no evaluation if the training materials provided are used or if they have a positive effect of R&I in practice.	ET
15	GeneBanC	Genetic bio and databanking: confidentiality and protection of data. Towards a European harmonization and policy.	Yes	GeneBanC was a research project that investigated privacy and confidentiality issues, the existing regulatory framework, ethical and policy issues, and governance aspects regarding biobanks. The project provides descriptions and analysis of biobanks including factors for success and failure, a mapping and comparison of legal frameworks for biobanks, and an analysis of the issue of confidentiality. Furthermore, they analysed the impacts of funding arrangements on ethics and governance. Thus, GeneBanC could be a suitable case study.[15]	ET
16	GEST	Global Ethics in Science and Technology.	Possibly	GEST investigated the role of ethics in science and technology policy and policy-making in Europe as well as in China and India, which are – besides the USA – the most important partners in S&T for Europe. It wanted to develop policy recommendations as a collaborative roadmap.	ET PE

[15] Dierickx, K., & Borry, P. (Ed.) (2009). New Challenges for Biobanks: Ethics, Law and Governance. Antwerp/Oxford/Portland: intersentia.

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
				In three case studies (food technologies, nanotechnologies, synthetic biology) that are based on desk research, the project wanted to explore how policy-making is determined by societal factors and especially ethical considerations and values and how public participation is institutionalised in different contexts. Furthermore, the discourses on the different technologies in the countries under investigation are analysed and compared. The project did not produce new empirical data and resorts to the analysis of existing research and policy documents. It mainly looked at how ethical considerations and values influence S&T policy-making and development, but the analysis of the impact of certain measures to include ethics is marginal. The first overview showed that there is a lot of information on different attempts of participation and the inclusion of ethics in policy-making, but few on the wider benefits of them. However, further analysis of the output materials might provide insights into benefits especially of participatory measures.[16]	
17	NANOCAP	Nanotechnology Capacity Building NGOs	No	The project researched the environmental, occupational health and safety risks as well as ethical aspects of nanotechnology by facilitating organised discussions between NGOs, trade unions, academic researchers, and further stakeholders. The different participant groups should be enabled to formulate an own position on nanotechnology. Besides the position paper of the NGOs and trade unions, project publications mainly deal with describing and assessing different nanotechnologies. The project also developed and published policy recommendation on how to address health, safety, and environmental issues of nanotechnology.	ET

[16] Results can be found in an open accessible book: Ladikas, M., Chaturvedi, S., Zhao, Y., & Stemerding, D. (Eds.) (2015). *Science and Technology Governance and Ethics. A Global Perspective from Europe, India and China*. Heidelberg: Springer.

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
				No systematic evaluation had been conducted on the impact of the measures taken on different areas. The project provides little information about the effects including benefits of different ethics measures and thus is not suitable as case study.	
18	NanoCode	A multi-stakeholder dialogue providing inputs to implement the European Code of Conduct for Nanosciences & Nanotechnologies research.	No	The project aimed to develop a framework that should promote the implementation of the European code of conduct for responsible research and development in the fields of nanoscience and nanotechnologies. Therefore, the code of conduct and other related measures and practice were analysed, a stakeholder consultation conducted, and an assessment tool (CodeMeter) created. The CodeMeter should enable stakeholders to assess their compliance with the code of conduct. Furthermore, a MasterPlan, a concept to support integration via sanctions and incentives, was produced. The effects of the CodeMeter or MasterPlan were not evaluated and measured. Thus, the project does not provide information on the impact of such measures and is not a suitable case.	ET
19	PATS	Privacy Awareness Through Security Branding.	No	The PATS project wanted to raise privacy awareness in different areas, including government agencies and private companies, by developing security brand indicators. At first, they mapped the field of civil security actors in different countries, analysed the privacy awareness of different actors, and their symbolic representation of privacy awareness.[17]	ET
20	NANOPLAT	Nanoplat: Development of a Platform for Deliberative Processes on Nanotechnology in the European Consumer Market.	Yes	NANOPLAT was a support action that evaluated deliberative processes on nanotechnology in Europe and itself developed a platform to facilitate science based and deliberative stakeholder dialogues. Thereby, they not only identified involved organisations, methods, and purposes, but also the results of the deliberative processes, which they categorise into direct and tangible or indirect and intangible. From the	PE

[17] Guagnin, D., Hempel, L., Ilten, C., Kroener, I., Neyland, D., & Postigo, H. (2012). *Managing Privacy through Accountability*. London: Palgrave Macmillan. // http://www.pats-project.eu (accessed 10 March 2015)

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
				first review, it is not clear if the project produced empirically grounded assessments of the impact of the different deliberation processes (in all or at least some of the analysed cases). Nonetheless, it seems a suitable project for an in-depth review, because of its focus on the results/outputs/impacts of instruments and approaches towards a better participation of different stakeholders in the field of R&I.[18]	
21	EUIMA	Take-up activities by universities of specific guidelines and recommendations to implement their modernization agenda.	Possibly	The EUIMA support action addressed the issues of sustainable funding, with a focus on the implementation of full costing models, and of further developing assessment tools for university research, in order to better considering diversity in their orientation and working mode (especially collaborative research). Project outputs were an Assessment Tool for University-Business Research Partnerships. They worked on these topics by conducting case studies and stakeholder workshops. Though the project has an empirical basis and analysed the impacts of the conduct of collaborative projects (e.g. through reported impacts in surveys) it is not yet clear if it fits into the research focus of MoRRI, because both, the input side (Are assessment tools a research governance instrument?) and outcome side (e.g. development of networks or of the institution itself, …) are not fully in line with the RRI dimensions (OA, PE, GE, SLSE, ET) and areas of benefits (economic, democratic, societal benefits) identified in MoRRI.	Research governance
22	GAP2	GAP2 – Bridging the gap between science, stakeholders and policy-makers. Phase 2: Integration of evidence-based knowledge and its application to science	Yes	GAP2 (MML; follow-on project to the GAP project) wanted to promote dialogue between fishermen, scientists, and policy-makers in order to develop innovations for sustainable fisheries. They tried to made research and innovation more inclusive and open to societal stakeholder and evaluated the impact of this participatory approach. In the project, 13	PE

[18] Strandbakken, P., Scholl, G., & Stø, E. (2012). *Consumers and Nanotechnology. Deliberative Processes and Methodologies*. Boca Raton, FL: CRC Press.

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
		and management of fisheries and the marine environment.		empirically grounded case studies were conducted on different topics (in the field of fisheries) in different countries. There is a short summary of each case study and scientific papers on several of them. Although not all of them seem to be relevant to the topic of RRI, there are several explicitly dedicated to technical innovations and their impacts in the field of fisheries. Therefore, and because they cover a field that is not much covered by most of the other EC funded projects under consideration, GAP2 could be a possible case, respectively it could provide several cases for further analysis.[19]	
23	NECOBELAC	Network of collaboration between Europe and Latin American Caribbean countries to spread know-how in scientific writing and provide the best tools to exploit open access information in public health.	Possibly	The project wanted to improve scientific writing, to promote Open Access publication, and to encourage cooperation between Europe and Latin American Caribbean countries. Therefore, it implemented a "train-the-trainer" strategy, conducting courses for scientists in the participating countries. After the courses took place, participants had to fill out an online survey. The obtained data was then used to assess the impact of the courses. There are empirical results that show how the activities of the project had an impact on Open Access publishing activities or on the construction of OA institutional repositories. However, the project does not ask about the socio-economic or democratic impacts itself; thus, it might only be a case if Open Access itself is seen as a democratic impact.	SLSE OA
24	PACITA	Parliaments and Civil Society in Technology Assessment.	No	The PACITA project aimed to promote knowledge-based policy-making on science, technology, and innovation issues by means of different parliamentary TA practices. It documented and analysed existing parliamentary TA practices, conducted training activities (summer schools, practitioners meetings) and parliamentary TA debates. It also set up example three projects (Public Health Genomics, Ageing society, and Sustainable Consumption) to exemplify the	PE ET

[19] http://gap2.eu/ (accessed 14 March 2015)

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
				methodologies of expert bases methods, stakeholder involvement, and citizen consultation.	
25	SIAMPI	Social Impact Assessment Methods for research and funding instruments through the study of Productive Interactions between science and society.	Possibly	SIAMPI developed a method to assess the social impact of research. Therefore, it conducted literature review, developed an analytical framework, and conducted several case studies in the areas of health care research, ICT, nanotechnology as well as social science and humanities. The project was concerned with research in general and not particularly responsible research. A closer look into the cases is necessary to assess if they analysed research activities that include RRI measures (gender, participation, etc.) and if the impact of these were analysed too.	
26	SOAP	Study of Open Access Publishing.	No	The project collected and analysed data on Open Access publishing in science. It looked at the share of Open Access articles compared to traditionally published articles in different science fields and also analysed believes, attitudes and practices of researcher towards Open Access publishing. The project provides statistics and data about Open Access (in 2009), but did not analyse the impacts of Open Access on society, democracy, or the economy. Thus, it is not a suitable case for MoRRI.	OA
27	ULAB	European Laboratory for modelling the Technical Research University of Tomorrow	No	In ULAB, five technical universities from across Europe work together to develop university policies for research, valorisation, entrepreneurship, and outreach. They do so by exchange of existing best practices and conducting pilot experiments. These pilot experiments were assessed regarding the impact of best practice implementation on research quality (excellence). The impact of the developed best practice guidelines on other universities was not evaluated.	-
28	CRÊPE	Co-operative Research on Environmental Problems in	Possibly	The project brought together civil society organisations (CSOs) and researchers in order to conduct research on environmental	PE

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
		Europe.		issues in agriculture. In CREPE, several case studies were conducted together with the CSOs.[20] The overall characteristics and output of this cooperative research processes were described and assessed in a separate report. However, from the first scan it is not clear if the reports analyse and empirically underpin the impact of such a participatory approach in diverse areas (research quality, etc.).	
29	2WAYS	Two WAYS for Communicating European Research about Life Sciences with Science Festivals & Science Centres/Museums, Science Parliaments & Impact Survey.	Possibly	The 2WAYS project developed and implemented new interactive science presentations for a lay audience on still active scientific research. They also conducted a survey on the impact of these presentations on the audience of science festivals (questionnaires for visitors) and conducted other events (science parliaments, final event). However, there is little information online available and further research is needed to obtain documentation. Only then it is possible to assess, if the project is usable as a case for MoRRI.	SLSE
30	LINDAU NOBEL	58th Meeting of Nobel Laureates at Lindau in 2008	No	Non-call projects that brought together Nobel Laureates and young researchers from different countries for sharing their knowledge, discussions, and networking. A wide and interdisciplinary range of scientific topics were covered in meetings, panels, and lectures. The impacts on participants and especially the positive effects on the careers of young researchers have not been evaluated.	SLSE
31	PERARES	Public Engagement with Research and Research Engagement with Society	Possibly	PERARES wants to strengthen public engagement in research, involving researchers and Civil Society Organisations in the formulation of research agendas and processes. Development and piloting of different formats like a transnational web portal for dialogues or science shops in several countries. There is no data available on possible impacts or the sustainability of those measurements and it would have to be collected.	PE

[20] http://crepeweb.net/?page_id=339 (accessed 24 March 2015)

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
32	PLACES	Platform of Local Authorities and Cities Engaged in Science	Possibly	Network (and online platform) of organisations like science centres, museums, festivals, local authority administration respectively policy-makers, or regions and cities, to promote cooperation in their science communication activities. A cooperation of policy-making and science communication should be established in the long-term and changes in public structures and attitudes towards societal science discussions and citizen participation at a local and regional level should be implemented. Local Action Plans and City Partnerships could prove material for case studies, but data is not available in this project. The project also developed an impact assessment toolkit (http://www.openplaces.eu/resources/places/80649).	PE
33	SISOB	An Observatorium for Science in Society based in Social Models	Possibly	Goal of SISOB was to develop a tool (in form of open source software) for policy-makers and funding agencies to identify research with high social impact worthy of support. In order to use those tools and validate the methods, three case studies were conducted about researcher mobility, knowledge sharing, and peer reviewing processes. The tool might be interesting to use in other case studies.	GOV
34	ESCITY	Europe Science and the City: Promoting Scientific Culture at local level	Yes	ESCITY, the preceding project of PLACES, tried to promote the integration of science culture in society at a local authority's level. Traditional science communication activities (e.g. science fairs, public lectures) were carried out and local government representatives were invited to attend. The project wanted to establish a European community for those local and regional governments and social researchers as a place of exchanging information and best practice. Case studies were carried out in order to compile examples of best practice, also a guideline was developed addressing local governments on how science cultures can be enhanced in cities. The case studies gathered 38 cases "benchmarking […] regional and local policies aimed at engaging citizens, especially those ones developed by cultural departments, paying special attention to those raising young people's	PE

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
				interest in science and women's role in its development". Those had to already be carried out so it was possible to get data allowing their assessment.	
35	ESOF	EuroScience Open Forum 2010	No	"ESOF – EuroScience Open Forum – is the biennial pan-European meeting dedicated to scientific research and innovation. At ESOF meetings leading scientists, researchers, young researchers, business people, entrepreneurs and innovators, policy makers, science and technology communicators and the general public from all over Europe discuss new discoveries and debate the direction that research is taking in the sciences, humanities and social sciences."[21]	PE (partly)
36	ACUMEN	Academic Careers Understood through Measurement and Norms	No	ACUMEN "aimed at understanding the ways in which researchers are evaluated by their peers and by institutions, and at assessing how the science system can be improved and enhanced."[22] A new set of criteria and guidelines for good evaluation practices were developed. No formal mechanisms were implemented for evaluating the impacts of benefits of the project. There is a report about gender effects on evaluation indicators though.	GE (partly)
37	ECB	European Coordinating Body in Maths, Science and Technology Education (ECB)	Yes	The ECB set out to strengthen the link between science education (STEM – Science, Technology, Engineering, Mathematics) and science technology careers within the industry and by that help closing a future gap of jobs and professionals. Multimedia tools and guidelines for best practice and innovation in teaching and teacher training were developed in order to attract young people to those fields. The project conducted an evaluation of the impacts on children's attitudes and could therefore be used for a case study.	SLSE
38	ESTABLISH	European Science and Technology in Action Building	No	ENCOURAGE set out to "encourage, disseminate and promote the use of inquiry-based education (IBE) for secondary level	SLSE

[21] ESOF2020 at the CORDIS database: http://cordis.europa.eu/project/rcn/94262_en.html (accessed 24 March 2015)

[22] ACUMEN website: http://research-acumen.eu/about (accessed 24 March 2015)

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
		Links with Industry, Schools and Home		students (12-18)". Teaching and education material has been developed for students as well as for teachers across 16 different science sectors. Multiple stakeholders have been involved in this. No impact has been evaluated.	
39	EUCYS 2011	European Union Contest for Young Scientists 2011	No	EUCYS is a yearly held contest that shall promote scientific exchange amongst young researchers in Europe and guide them into future careers in science and technology. The impact on the participants has not been evaluated.	SLSE
40	FIBONACCI	Large scale dissemination of inquiry based science and mathematics education	Possibly	FIBONACCI takes on the effort of previous projects to disseminate IBSME (inquiry-based science and mathematics education methods) at a local level and wants to "design, test and formalize a process for disseminating" IBSME in primary and secondary education throughout Europe in order to enhance scientific literacy from an early age and to reinforce scientific careers. Guidelines and other materials have been developed; the dissemination builds on 12 Reference Centres in Europe. The project could be used as a starting point for a case study.	SLSE
41	PRIMAS	Promoting inquiry in mathematics and science education across Europe	Yes	PRIMAS' goal is to promote the "use of inquiry-based learning (IBL) within science and mathematics education" in order to enable and improve the experiences of students with STEM subjects. For that purpose, teaching material, teacher education, and classroom guidelines have been developed and disseminated throughout Europe. Multiple stakeholders have been involved in this process. In order to measure the impact of the project, summative and formative evaluations have been conducted in which data was collected and national activities were monitored and case studied. Material is not available on website and would have to be asked for.	SLSE
42	S-TEAM	Science Teacher Education Advanced Methods	No	S-TEAM focuses on developing best practices in science education by combining existing research in order to stimulate learning in science. As optimal approach was identified the inquiry-based science teaching (IBST), which emphasises own exploration of scientific problems. Three stakeholder groups were targeted in disseminating the outcome: policy-makers,	SLSE

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
				teachers and teacher educators. Some evaluation has been conducted at a national level, but impact has not been evaluated.	
43	SIS CATALYST	Children as Change Agents for the future of Science in Society	No	SiS CATALYST has the ambition to make children change agents in the relationship of science and society. The access to higher education should be based on the child's abilities, whereas at the moment it lies more on cultural variables. Different measures and steps were taken for that. Impact measurement was one work package of the project, material and results of which cannot be found on the internet and would have to be researched. Additional information for a case study would have to be gathered.	SLSE
44	UPDATE	Understanding and Providing a Developmental Approach to Technology Education.	No	UPDATE wanted to improve and promote "science and technology teaching in Europe in order to make technology more attractive to young people." For that purpose, it focused on a young age, namely early childhood and primary education, to spark interest and abilities. The project examined possible reason for high dropout rates of girls in technology education, designed new teaching materials and education methods and on the long run mobilise young people for future careers in engineering and technology. Pilot studies were conducted in order to gather expertise, but no benefits of RRI were touched in those.	SLSE
45	ALACs	Promotion of Participation and Citizenship in Europe through the ALACs of Transparency International	No	The project focuses on Advocacy and Legal Advice Centres set up by Transparency International. Those provide "free and confidential advice and support to witnesses and victims of corruption" and were "analysed and enhanced across Europe in order to generate better scientific knowledge and best practice models of civil society activities" in anti-corruption. Since the project does not focus or account for corruption in research and innovation specifically, it is of no use for case studies.	PE ET
46	CIVI.NET	The capacity of CSOs and their networks in community based environmental	No	CIVI.NET chose regions in Brazil and Costa Rica where communities successfully faced the "challenge of reorganizing the management of natural resources as a result of environmental changes and degradation" as case studies.	PE

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
		management		Those successful and sustainable community-based approaches were analysed and transferred to other communities with similar challenges. The outcome is disseminated in different measurements: guidelines, training and publications. Since the project deals with environmental challenges of communities, it is not suitable for case studies of benefits of RRI.	
47	COMBIOSERVE	Assessing the effectiveness of community-based management for biocultural diversity conservation.	No	COMBIOSERVE wanted to "develop new scientific and technological knowledge that can help in understanding and characterizing locally developed forms of community conservation", community-based resource management and conflict resolution strategies. For that goal it focused on four field sites in South and Central America, where conditions and principles of success were identified, involving local researchers. Since benefits of RRI are not part of the project, it is unsuitable as a case study.	PE
48	GEOFAIR TRADE	GeoTraceability Fair Trade	No	The project aimed to create improved, standardised information on Fait Trade activities in form of an online tool. Greater transparency about the producers for the customer and bringing them closer together was goal of that tool. Since CSOs play a key role in Fair Trade, the project linked them with research performers. Though the involvement of CSOs shows the dimension of participation/civil engagement, no data concerning the long-term the benefits has been collected and thus a case study would be hard to conduct.	PE
49	COMET-LA	Community-based Management of Environmental challenges in Latin America	No	The project set out to identify "sustainable community-based governance models for the management of natural resources that could be used in different social-ecological systems in a context of climate change and increasing competition for the use of these resources". In a participatory learning area, the community-based management of natural resources was analysed and best practices identified under the involvement of different stakeholders, amongst them CSOs. Three case studies were conducted in Mexico, Colombia and Argentina, but the subject is again not the benefits of RRI.	PE

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
50	COBRA	Coordination of Biological & Chemical IT Research Activities	No	COBRA dealt with the "emerging field of biological and chemical information technologies". Background challenges and motivating factors were described, different approaches to its realisation were introduced, possible impacts imagined and it was illustrated in five case studies of suitable projects. No benefits of RRI were part of the project.	-
51	PANGEO	Enabling access to geological information in support of GMES	Possibly	PANGEO project developed a free and Open Access portal on which the different targeted user groups (local authority planners and regulators, national geological surveys and institutes, policy-makers, general public, commercial sector) can get geohazard information for 52 participating towns and cities in Europe. In order to do so the project gathered and interpreted a range of data and information on geological processes. For a better promotion and dissemination of the portal, case studies of users have been conducted, studying the benefits and value of the final product. The material is not available on their homepage, but might prove interesting for a case study on Open Access.	OA
52	PASSO	Participatory Assessment of Sustainable Development indicators on good governance from the Civil Society perspective	No	PASSO aimed to develop "a set of effective, coherent and useful indicators of good governance that take better account of the perspective of civil society and that can be used in Europe to support the monitoring of sustainable development". Civil society representatives were involved in a participatory process that led to a governance framework and a set of 30 indicators. No case studies were conducted in the project.	PE
53	CIT-PART	Impact of Citizen Participation on Decision-Making in a Knowledge Intensive Policy Field	Yes	The project studied the impact of PTA and TA on policy-making in various European countries, the EC, the OECD, and the Vatican and furthermore the potential impact of citizen participation at the EU level on the example of xenotransplantation. Case studies were conducted about the examined countries and xenotransplantation policies, which could provide information about the dimension Public Engagement in those countries.	PE
54	TECHCLINIC	Setting-up of effective	No	The project set out to change the attitudes of young people	SLSE

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
	SST	Technological Clinics to address real knowledge needs of Surface Transport.		towards the surface transport industry. In this sector, shortages of qualified personnel exist while there is a high level of unemployment in most EU countries. TECHCLINIC SST wanted to close this gap in motivating young people to choose education in this sector. For that purpose, technology clinics and scientific cafés were established in different countries, directly involving students with the industry. It does not seem as though benefits were surveyed, but the existing material is very scarce.	
Explicit RRI projects					
55	Res-AGorA	Responsible Research and Innovation in a Distributed Anticipatory Governance Frame. A Constructive Socio-Normative Approach.	Yes	The Res-AGorA project aimed to develop a comprehensive governance framework for RRI. Therefore, theoretical reflection, empirical work, and stakeholder engagement were conducted. Approximately 30 case studies form the core of the project; these are concerned with existing practices in different scientific and policy fields that support or prevent RRI. Furthermore, a monitoring of RRI activities in 16 European countries was conducted. The case studies are quite diverse; they differ in terms of technology field (nanotechnology, fracking, synthetic biology, biofuels, etc.) as well as research focus (on methods of technology assessment, research infrastructures, standardisation, etc.). Though not all of the case studies provide evidence of the benefits of RRI (but in some cases rather the negative effects of "non-RRI") there are several case studies that could be useful for identifying benefits of RRI.[23]	RRI
56	PROGRESS	Towards a European normative model for Responsible Research and	Possibly	PROGRESS wants to develop and implement a normative model for RRI drawing on existing constitutional values as normative basis. In that, PROGRESS analyses and compares	ET

[23] The Res-AGorA project was still active at the time of the research for the first round of case studies and not all case studies were finalised and accessible at that point (http://www.res-agora.eu, accessed 24 March 2015). The project was concluded end of January 2016.

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
		Innovation globally, using constitutional values as a driver to inform societal desirability.		science funding strategies in different countries (including Europe, the USA, China, Japan, etc.). In the project, three case studies have been conducted in the fields of Synthetic Biology, Nanotechnology, and ICT. However, the case studies only give an overview and evaluation of ethical challenges regarding the different technologies or innovations, but not on the impact of implementing RRI. In the future, the PROGRESS project including its impact in different areas might be analysed as an example of RRI practice itself.[24]	
57	Responsibility	Global Model and Observatory for International Responsible Research and Innovation Coordination.	Yes	RESPONSIBILITY is developing a stakeholder network to adopt and diffuse a common concept of RRI between different stakeholders in the EU and worldwide. Therefore, it wants to produce policy recommendations and guidelines (a model and tool for cooperation) as well as a so-called "Observatory", which collects and holds available RRI related materials (policy documents, case studies, articles, etc.). The project also initially produced 21 case studies for their case study collection (as well as a reusable case study template) focusing on different RRI issues in various contexts and technology fields. These (might) provide valuable insights into effects and benefits of RRI.[25]	RRI
58	GREAT	Governance for Responsible Innovation.	Possibly	The GREAT project analysed five research projects that worked on ageing and care for older people, care for the environment, and public service for citizens and businesses. In their cases, they focused on (1) if and how the funding programme (EC) had certain requirements with regards to RRI, and (2) what ethical challenges the projects had to face. In the future, the impact of the project, as an instrument of promoting RRI, can be analysed.[26]	RRI (ET)

[24] http://www.progressproject.eu/ (accessed 24 March 2015)

[25] http://responsibility-rri.eu/ (accessed 24 March 2015)

[26] http://www.great-project.eu/ (accessed 24 March 2015)

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
59	RRI Tools	RRI Tools. Fostering Responsible Research and Innovation.	Possibly	The RRI Tools project wants to develop a toolkit (training materials, best practices, guidelines, etc.) that can be used in order to promote RRI. For production and dissemination of this toolkit, a consortium and RRI Hubs covering 30 countries have been set up. At a later stage of the project, the impact of this toolkit will be evaluated. However, at the moment (March 2015) there are not many results yet, since the project just recently started (2014). At a later point in time, it might be useful to re-assess the project as a case for MoRRI.[27]	RRI
60	Responsible-Industry	Responsible-Industry	Yes	The Responsible Industry project produced several case studies[28] that deal with concrete innovations, how they were developed, how RRI aspects were considered in the development process and what impact this had.[29]	RRI
61	NERRI	Neuro-Enhancement responsible research and innovation.	Possibly	NERRI wants to introduce the concept of RRI in the field of neuro-enhancement and to model a governance framework for this purpose. It does so by facilitating a broad societal discussion, including stakeholder involvement and different mobilisation and mutual learning activities. In the future, the impacts of the RRI activities in NERRI could be analysed, but at the moment, there are no results on their wider impacts.[30]	ET PE
62	SYNERGENE	Responsible Research and Innovation in Synthetic Biology.	Possibly	SYNERGENE is a mobilisation and mutual learning action, which aims to promote RRI in synthetic biology by conducting a dialogue between different stakeholders on the benefits and risks of synthetic biology. In the future, the impact of the activities in the project could be analysed, but at the moment, there are no results on the wider impacts of this RRI	ET PE

[27] http://www.rri-tools.eu/ (accessed 24 March 2015)

[28] Case studies were produced by researchers outside the project; there was an open call for competition on case studies that demonstrate how RRI can be implemented and what impacts RRI has. Webpage: www.responsible-industry.eu/ (accessed 20 March 2015)

[29] http://www.responsible-industry.eu/ (accessed 24 March 2015)

[30] http://www.nerri.eu/ (accessed 24 March 2015)

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
				promoting project.	
63	irresistible	Engaging the Young with Responsible Research and Innovation.	Possibly	The irresistible project wants to design activities to support participation of students and the public in RRI processes. In the project, science education.[31] In the future, the impact of the activities in the project could be analysed, but at the moment, there are no results on the wider impacts of this RRI promoting project.	SLSE PE
64	PARRISE	Promoting Attainment of Responsible Research & Innovation in Science Education.	Possibly	PARRISE promotes RRI in the field of primary and secondary education. The project collects and distributes best practices in different countries and develops a framework for socio-scientific inquiry-based learning. Thus, the project wants to promote democratic citizenship. Later, they want to evaluate the use and success of the developed materials and framework.[32] The project started in 2014 and there are not many results yet. However, in the future the project itself might be a case for MoRRI.	SLSE
65	SATORI	Stakeholders acting together on the ethical impact assessment of Research and Innovation.	Possibly	SATORI wants to develop a framework for ethical impact assessment of research and innovation. To this end, relevant projects and stakeholders, effects of globalisation on R&I, and other related issues are identified and analysed. Furthermore, there will be collaborations with different stakeholders in order to bring in a variety of perspectives. Two SATORI work packages deal with risk-benefit analysis and measuring impacts of ethics assessments. However, the project started in 2014 and the respective deliverables are not finished yet.[33]	ET
66	NanoDiode	Developing Innovative Outreach and Dialogue on responsible nanotechnologies	Possibly	NanoDiode establishes a coordinated programme for outreach and dialogue to support governance of nanotechnology. Therefore, stakeholder engagement and dialogue are	SLSE PE

[31] http://www.irresistible-project.eu/index.php/en/ (accessed 24 March 2015)

[32] http://www.parrise.eu/ (accessed 27 March 2015)

[33] http://satoriproject.eu/ (accessed 27 March 2015)

ID	Acronym	Name	Possible Case?	Argumentation	Dimension(s)
		in EU civil society.		promoted by different activities (idea competitions, surveys and interviews, stakeholder dialogues, establishment of user committees, scientific education, etc.).[34]	
67	CONSIDER	Civil Society Organisations in Designing Research Governance	Yes	CONSIDER aimed to examine SCO participation in research. For that, it surveyed all FP7 projects and did case studies for more than 30 relevant projects, from which a model of participation was developed. In a further step, guidelines for stakeholders were developed, on how to involve representatives from CSOs into research. The case studies looked into dynamics of participation in research and the characteristics of participating CSOs. Impacts of the case study projects have been examined, which makes CONSIDER a good source for potential case studies in MoRRI.	PE

Annex III: Case study analysis sheets

1 GAP2

Table 15: Analysis sheet CS01

Case number	01
Case title	GAP2 – Bridging the gap between science, stakeholders and policy makers. Phase 2: Integration of evidence-based knowledge and its application to science and management of fisheries and the marine environment.
Short abstract	The GAP2 project implemented participatory activities in research in the field of fisheries. GAP2 conducted 13 case studies in eleven countries involving different stakeholder groups and fishers into the research process and aiming to make fishery more sustainable.
Scientific discipline	Marine Biology, Fisheries Science
Industrial sector	Fishing, aquaculture

[34] http://www.nanodiode.eu/ (accessed 27 March 2015)

Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	Variety of MML activities
Impacts	**Overall assessment**
	Society
	The activities facilitated communication between different actors and actor groups that would otherwise not come together and communicate with each other. The authors of the study speak of trust building between different actors, which makes interaction easier. All of this s effected in easier everyday activities, because actors shared some common knowledge and objectives.
	Democracy
	Economy
	One case within the project speaks of economically positive effect, because of new way of conduct (higher sustainability).
Causal link and limitation	The relationship between activity and impact corresponds with the impact logic of the activity itself. E.g. the causal link between mutual mobilisation and learning activities and a higher degree of communication is evident. By getting to know each other in the wake of more communication, trust building might be explained.
RRI activity/measure II	
Description of RRI activity	Participatory action research, e.g. collaboration regarding data collection on fish stocks.
Impacts	**Overall assessment**
	Society
	Through participatory action research there has been a knowledge transfer between fishers and researchers. This effected in raised awareness and knowledge with regards to data collection, scientific practices on behalf of fishers. This higher competence in scientific practice also had a positive effect on the quality of data researchers and policy-makers build upon.

	Democracy
	The knowledge of fishers could be taken into account in decision-making processes.
	Economy
Causal link and limitation	See above
RRI activity/measure III	
Description of RRI activity	Inclusion of fishers in policy-making/decision-making processes.
Impacts	**Overall assessment**
	Society
	Democracy
	Empowerment of fishers (also through PAR).
	Economy
Causal link and limitation	See above
Discussion/Limitation of data	
Overall assessment of data quality	• Scientists were asked regarding the impact of their own work. • Two-time survey has not been finished. • Evidence base of certain claims on the benefits is often not clear. • Too early to evaluate the impact.
Possible indicators	

2 CIT-PART

Table 16: Analysis sheet CS02

Case number	**02**
Case title	CIT-PART – Impact of Citizen Participation on Decision Making in a Knowledge Intensive Policy Field
Short abstract	CIT-PART deals with Participatory Technology Assessment (PTA) on the issue of Xenotransplantation and if PTA has an impact on decision-making processes. In the case study, three case studies from the CIT-PART project are used to illustrate the impacts of citizen participation measures (Canada, Switzerland, and the Netherlands).
Scientific discipline	Biotechnology, Xenotransplantation
Industrial sector	
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	Participatory Technology Assessment including various formats, such as outreach and information activities, workshops, public advisory groups, consensus conference, public debates, etc.
Impacts	**Overall assessment**
	The PTAs had limited impact on the formal decision-making process. However, they had impact in other societal areas.
	Society
	• Stimulation of public debate on Xenotransplantation. • Better public knowledge about Xenotransplantation and partial change in perception. • New networks between actor groups emerged.
	Democracy
	• Reflection on behalf of political decision-makers. • No direct influence on political decision-making process. • Institutional learning: new means were adopted to promote transparency and openness of own work (Canada).
	Economy
Causal link and limitation	• Public campaigns and diffusion of information led to public debate and more informed public. • Institutional learning happened because of experiences of public administration in the course of process (link unclear).

Discussion/Limitation of data	
Overall assessment of data quality	Results have a basis in qualitative data, derived from interviews with different stakeholders. The impact analysis thus strongly resorts to the statements of interviewed persons and the interpretation of case workers (e.g. influence on the public debate).
Possible indicators	

3 WiST

Table 17: Analysis sheet CS03

Case number	**03**
Case title	Women in Science and Technology – The Business Perspective
Short abstract	The WiST project wanted to promote a cultural change towards gender equality in science and technology companies. Participating enterprises implemented several measures and the impacts of more gender equality were then evaluated.
Scientific discipline	
Industrial sector	Industries (general)
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	Different measures to promote gender equality were conducted; however, from the case study it is not clear how they look like in detail. The case rather looks at the impact of more gender equality within the companies.
Impacts	**Overall assessment**
	Based on empirical evidence, it was shown that gender equality has a positive effect on individual performance in research and development units. For collective performance, there is lack of reliable data.
	Society
	The measures have the inherent societal benefit of promoting gender equality.
	Democracy
	Economy
	Higher individual and collective performance might lead to higher output, company performance and in the end higher

	economic revenue.
Causal link and limitation	Causal links are hard to establish due to the complex nature of the phenomena under consideration (external effects are hard to control).
Discussion/Limitation of data	
Overall assessment of data quality	Impact of gender diversity was measured using econometric modelling. Data was provided by four companies for one year (n=1506). However, due to the complex nature of the investigate phenomenon, the establishment of clear causal links was not possible.
Possible indicators	

4 PRIMAS

Table 18: Analysis sheet CS04

Case number	**04**
Case title	Promoting inquiry in mathematics and science education across Europe
Short abstract	PRIMAS wanted to promote the implementation of inquiry-based learning (IBL) in mathematics and science. Promoting and hindering factors were investigated and courses for multipliers (teachers) were developed, implemented and evaluated.
Scientific discipline	Mathematics
Industrial sector	-
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	The project trained multipliers, who in turn trained teachers in inquiry based learning techniques. Furthermore, there were support actions at a systemic level, e.g. publications, conference presentations, etc. Guidelines and teaching materials for use in classroom were produced.
Impacts	**Overall assessment**
	Implementation of IBL had positive effects on motivation, understanding, and interest of students regarding mathematics. Students gained confidence in dealing with mathematical questions, as well as teachers.
	Society
	More interest and motivation regarding mathematics might increase the number of students of mathematics.

	Democracy
	Both high and low ability students benefited from IBL. Thus, this activity might be beneficial in terms of societal equality.
	Economy
Causal link and limitation	The causality between the activity of IBL and the outcome (higher motivation) corresponds to the logic of the intervention: the use of a better, more suitable and more engaging teaching method results in more interested students and better learning outcomes. Further societal impacts (more math students, societal equality) are hard to attribute to a singular activity, but are speculation.
Discussion/Limitation of data	
Overall assessment of data quality	Case studies and a two-time survey (before/after project) amongst students, teachers, etc. were conducted. The project internal evaluation looked at benefits, expectations, and interests of the involved actors. Causal links between activity (IBL) and outcome (higher motivation, etc.) could be established via two-time survey.
Possible indicators	

5 Aarhus University – RCR

Table 19: Analysis sheet CS05

Case number	**05**
Case title	Institutional efforts to ensure and enhance responsible conduct of research: Lessons learned from Aarhus University.
Short abstract	The case study is concerned with measures to implement responsible conduct of research codes at Aarhus University (AU). Under the umbrella of a pan-university strategy for RCR, these measures include the development of rules for authorship practices, development of principles and standards for RCR, educational training in RCR, establishment of an advisory organ, a committee for RCR and an Office of RI.
Scientific discipline	Academic research
Industrial sector	-
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI	Aarhus University developed a pan-university RCR strategy comprising several concrete policy documents and measures

activity	to promote RCR at their university. • Rules for authorship practice • Procedures for data management • Code of Practice • Principles and Standards for RCR – University Policy on RCR • Educational training on RCR for students and faculty members • Establishment of Advisory Organ • Establishment of a Committee for RCR • Establishment of an Office of Research Integrity
Impacts	**Overall assessment**
	The impacts of these measures are assessed – by the case study – more or less at an aggregated level (RCR strategy), and not individually per measure. The measure themselves are assessed as an "output" of the overarching RCR strategy policy-making process. Beyond that, there are certain further impacts.
	Society
	The process raised awareness for RCR and RI and promoted discussion about these topics on a daily basis. Furthermore, practical research issues – e.g. on authorship and data handling - have been clarified. New courses of action emerged due to institutional change (e.g. whistleblowing, dealing with fraud, etc.).
	Democracy
	Economy
Causal link and limitation	The outputs of the RRI activities at hand reflect the inherent goals of the measures undertaken. The impacts (mid-/long-term) can only be assumed; there is no evidence or data for them.
Discussion/Limitation of data	
Overall assessment of data quality	The case study is based on expert interviews with people involved in the strategy process at AU and most relevant policy documents; thus, it was possible to describe the content and processes in detail. However, it is too early to evaluate the impact of the measures (activities were undertaken in 2015).
Possible indicators	

6 Gender and affirmative action: Lessons learned from the Danish Council for Independent Research

Table 20: Analysis sheet CS06

Case number	**06**
Case title	Gender and affirmative action: Lessons learned from the Danish Council for Independent Research.
Short abstract	The case study investigates the effects and benefits from a moderate affirmative action instrument in research funding processes. The Danish Council for Independent Research implemented YDUN, a programme that privileged female applicants in case of equally qualified research proposals.
Scientific discipline	Research funding
Industrial sector	-
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	YDUN (Young Women Devoted to a University Career) is a funding scheme to promote women in research. The programme is a moderate affirmative action: female candidates were preferred over male candidates if two or more candidates were equally qualified for a grant.
Impacts	**Overall assessment**
	Society
	The share of female first-time applicants is higher in the YDUN programme than in other comparable programmes. ("YDUN has been successful in encouraging an 'untapped' pool of early-career researchers to formulate their own project proposal for the first time.").
	The share of female applicants in total is higher (but data not clear-cut on this issue).
	Democracy
	Economy
Causal link and limitation	The impact corresponds to the objective of the measure (increase of female researchers with affirmative action). Through increasing the chance of receiving a grant, more female researchers applied for grants (higher motivation, higher

	incentive to invest time in writing proposals).
Discussion/Limitation of data	
Overall assessment of data quality	The case study uses secondary data collected by a consulting group. Due to the selection of a specific baseline, the effects might have been overestimated. The identification of a causal link between the YDUN programme and the increase in female research applicants is not entirely clear, because there is a normal annual fluctuation and variance.
Possible indicators	

7 Research Council of Norway

Table 21: Analysis sheet CS07

Case number	**07**
Case title	Research Council of Norway
Short abstract	The case study investigated the Research Council of Norway as institution also promoting RRI.
Scientific discipline	Research funding
Industrial sector	
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	
Impacts	**Overall assessment**
	Society
	Change in scientific culture due to inclusion of "RRI thinking" in larger funding calls; because of this inclusion, researchers do not only change the way they apply for grants, but in the end, the conduct of research projects change too.
	Democracy
	Economy

Causal link and limitation	See above. However, only anecdotal evidence.
Discussion/Limitation of data	
Overall assessment of data quality	Qualitative information from interviewees close to the institutions and subject matters. No clear RRI measures described; The RCN is depicted as an institution putting forward a certain meaning of RRI; this then effects other institution (research funding calls, etc.).
Possible indicators	

8 Austrian Agency for Research Integrity (OeAWI)

Table 22: Analysis sheet CS08

Case number	**08**
Case title	Austrian Agency for Research Integrity (OeAWI)
Short abstract	The case describes the work of OeAWI on research integrity and analyses in particular courses on research integrity for PhD students held by the OeAWI at higher education institutes.
Scientific discipline	Research; basic research, all disciplines
Industrial sector	n/a
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	Research integrity (RI) workshops
Impacts	**Overall assessment**
	RI workshops are very well accepted. (1) There is a high demand of RI workshops offered by OeAWI, (2) RI workshops are models in other European countries, (3) they are very positively evaluated by interviewed participants, programme coordinator and supervisor, and (4) RI is considered an important topic.
	Society
	• Raised awareness for the work of OeAWI since 2008. • Students are aware of a problem that goes beyond integrity at a personal level and learned about the existence of

	the OeAWI as a place to turn to if questions or problems connected to good scientific practice arise in the course of their research carrier. • RI workshops might improve the institutional culture and the exchange between colleagues at different levels of hierarchy (professors, assistants, students). They make aware of issues of authorship and plagiarism that otherwise might be disregarded. This contributes to fair science. • They do not see a direct influence on what they learned in the workshop on their work practice, but state a greater awareness and carefulness towards problematic issues and that the topic is being discussed amongst colleagues more often. • At one institution, processes were installed how to handle data generated by researchers that left the institution. • RI workshops raise awareness regarding good scientific conduct and proper presentation of ideas of others. It might prevent plagiarism, data piracy, data forgery, and misinterpretation of results. • Public confidence in science might be strengthened. Changes of institutional culture in science (towards fairness and recognition of merits) might make scientific careers more attractive to students.
	Democracy
	Economy
	The preventive function of RI workshops as well as mediation of cases of suspected misconduct outside court might avert legal problems and costs ("litigation costs"). Membership of the OeAWI might increase the reputation of a research organisation and therefore its attractiveness to raise funds. Costs of addressing RI include: • Membership of OeAWI. • Creating processes of RI and research ethics.
Causal link and limitation	There is no independent, (quantitative) accompanying evaluation of RI workshops available. Therefore, assessment is based on a limited number of qualitative interviews. Benefits and impacts can only be assessed cautiously due to the relatively short period of time the measures have been implemented.
RRI activity/measure II	
Description of RRI activity	
Impacts	**Overall assessment**

	Society
	Democracy
	Economy
Causal link and limitation	
RRI activity/measure III	
Description of RRI activity	
Impacts	**Overall assessment**
	Society
	Democracy
	Economy
Causal link and limitation	
Discussion/Limitation of data	
Overall assessment of data quality	No systematic evaluation of long-term impacts of RI workshops on individual and organisational level exists.
Possible indicators	

9 European Molecular Biology Organization (EMBO)

Table 23: Analysis sheet CS09

Case number	**09**
Case title	European Molecular Biology Organization (EMBO).
Short abstract	The EMBO is trying to develop OA/open science and to improve Research Integrity in the field of molecular biology, concentrating on training, outreach, and transparent publication processes with several initiatives promoting this. The case study is strongly focussing on the development of possible indicators. The assessment of impacts and links is valid for all the RRI activities and was not linked to single activities specifically.
Scientific discipline	
Industrial sector	Molecular Biology
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	**Online ethics courses** focusing on research integrity, available to both funded fellows of EMBOs various support programmes and to the members of EMBO (largely faculty scientists).
RRI activity/measure II	
Description of RRI activity	Inclusion of **talks and discussion sessions on research integrity issues**, integrated into the Annual EMBO scientific conference as Science Policy and Society sessions. These sessions are aimed at scientific researchers, with the goal of widening their perspective on integrity and ethics issues and societal interests in the conduct and outcomes of research. The Head of the Science Policy programme also gives invited talks about research integrity at the institution and/or laboratory level.
RRI activity/measure III	
Description of RRI activity	Documentation of **open science policies**. The key policy for this indicator involves guidelines on transparency – which overlap to some degree with the dimension of research integrity (due to the apparent linking of openness and the elimination of misconduct in many scientists eyes).
RRI activity/measure IV	
Description of RRI activity	**EMBO Press** publishes journals with focus on transparency, a quick single round review process and the option to make data and other elements available to readers in the interests of openness, thus promoting the publication of ”transparent papers”. These papers provide the source data for all figures included in the paper with additional annotation and information possible to ensure the process of interpretation of these data can also be followed. Transparent paper publishing involves the inclusion of a tab marked transparent process, alongside tabs for the article and the tables and

	figures. This tab includes a link to the review process file, where the reviewers' comments, the authors' replies, and the correspondences with the editor can be viewed. The investment in the transparent publishing process has been shown to have a positive impact on the integrity of data and information published in scientific articles.
RRI activity/measure V	
Description of RRI activity	**Institutional mechanisms** for promoting open science, inclusion of an open science agenda in the conferences, and linked training sessions at the EMBO annual meetings and other gatherings. In addition, EMBO provides funding for workshops run by scientists. It would potentially be possible to also monitor, through programmes and agendas, the extent to which open science content was present within these funded support actions.
RRI activity/measure VI	
Description of RRI activity	CC0 "no rights reserved" licence option for data associated with papers A CC0 licence is not required for EMBO publications, rather it is a suggested opt-in system. Even authors of papers that are subscription only can still opt to make their data freely available.
Impacts	**Overall assessment**
	The main beneficiaries of the activity are within the emerging research community, postdocs, young faculty and researchers who are engaging with the RRI landscape less as a transformation from the past and more as the emergent configuration of scientific excellence, societal expectations and institutional imperatives.
	Society
	Democracy
	Economy
Causal link and limitation	The attribution of causal links between process indicators and identifiable outcomes is problematic. For example, increasing trends in take-up of RCoR training by junior fellows of EMBO allows us to identify the input of a specific research integrity mechanism to address normative tensions in policy/societal expectations and actual practices. However, unless a method is developed to actually document the impact of this training in the lab, in the design or conduct of research, or in the attitudes and normative stance being transferred from trained fellows to postgraduate students, for example, a causal chain cannot be established. However, there is certainly the possibility that targeted research and data collection could seek to make this link using conventional and/or innovative research methods.
Discussion/Limitation of data	
Overall assessment	Data derives mostly from EMBO's Facts and Figures report and a supplementary interview conducted with the head of the

of data quality	science policy programme. Measurement was done at an input level; the significance of data was limited by the early stage of some activities. It is important to note that the research integrity and Open Access/science activities of EMBO that are addressed here are in the relatively early stages of development. The data sources described in this sketch are feasible data sources. EMBO have indicated that as a further step in this case study concrete data could be made available for further developing the contours of the indicators proposed here. It would therefore be premature to try to associate specific social, democratic, or economic benefits to the RRI activities described at this stage.
Possible indicators	Process indicators: • Ethics 1: Responsible Conduct of Research (RCoR) courses completed by a) funded postdocs and fellows and b) EMBO members; • Ethics 2: Number of sessions/hours devoted to RCoR in annual meetings and outreach talks; • Open 1a: Number of policies online, number of policy views/downloads from EMBO site; • Open 1b: Number of "transparent papers" submitted to EMBO journals annually, transparent papers as proportion of total publications; • Open 2: Number of sessions/hours devoted to promoting open science in annual meetings and outreach talks. Outcome indicator: • Open 3: Number of CC0 data licence opt-ins in EMBO journals annually, CC0 licences as proportion of total data licence selected.

10 UK Science Media Centre

Table 24: Analysis sheet CS10

Case number	**10**
Case title	UK Science Media Centre
Short abstract	The case considers the Science Media Centre (SMC) in the United Kingdom. The SMC is an "independent charity working to promote the voices, stories and views of the scientific community to the news media when science is in the headlines." The SMC aims to promote accurate and evidence-based information about scientific subjects, especially in complex and controversial topics when reporting runs a risk of becoming confused and misinformed. Thereby, the public and policy-makers are protected from misleading reporting. It represents and promotes the views and opinions of the scientific community, covering all the disciplines of the natural and physical sciences as well as engineering, to the mass media. The SMC offers several products for journalists and scientists alike, for instance rapid reactions, press conferences or trainings.
Scientific discipline	Research, all disciplines of Natural and Physical Sciences and Engineering

Industrial sector	
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	The SMC acts on a national scale in the United Kingdom. The SMC has two main target groups Scientists and media. Registered journalists receive daily information in different formats. The following formats are provided by the SMC: • Fact Sheets: short summaries on new scientific areas, which received little media attention in the past, but are suddenly in the spotlight. • Briefing Notes: notes on controversial scientific topics, which provide a snapshot of the basics and an objective run-down of controversial points from a scientific perspective. • Rapid Reactions: respond to breaking news by providing leading experts to media for interviews or immediate comments. • Roundups: ensure the media have easy access to scientists and their views to put new research findings into context. This service differs from the "rapid reactions" in the sense that scientists can prepare for the announcement of new research without time pressure and that they allow for a longer planning horizon. • Briefings: agenda setting for scientists in the form of regular briefings, taking either the form of background briefings (introducing journalists to the best experts on controversial topics) or news briefings (providing a news story on developments within science). • Before the headlines: provision of brief, independent statistical analyses of scientific papers with accompanying critiques of the authors' conclusions in a short format (provided by volunteer statisticians). The SMC also offers specialised resources and support for scientists and press officers: • Support for scientists: support for scientists to engage with the media, offering expertise in the area of science media relations. • Guides: guides advising for instance on how to answer complex questions in a two-minute interview, risk and uncertainty, the peer review process, etc. • Media induction training: a one-day training session with media-experienced scientists, journalists etc. These experts provide insights into the work of the news media for other scientists who wish to better understand its demands and facilitate working with them. • Brainstorming sessions: off the record discussions on how the scientific community can coordinate its media relations on controversial issues. • Advisory sessions: occasional subject-focused sessions in anticipation of big controversial stories. • Provision of a neutral venue: press officers of companies and other organisations can use the SMC as a neutral venue to engage with the press. The outputs of the SMC have increased 10-fold between 2002 and 2012. In 2013, the SMC issued 80 press briefings, 260 rapid reactions and roundups responding to breaking and upcoming stories and handled several hundred media calls and requests (Hettwer et al., 2013; SMC, 2014).

Impacts	**Overall assessment**
	Journalists argue that the SMCs improved the standing of science topics in the news media, increased the coverage of science topics, reduced anti-science reporting and contributed to a positive public view on science. It has also been argued that the SMC has been able to objectify public debates about science (Hettwer et al., 2013). However, critics have argued that the SMC is being biased towards science and around fostering a reporting that is too science-friendly at times (see also Callaway, 2013). This critique implies that SMC can hardly contribute to (scientific and) societal debates about fundamental issues for instance the governance of science.
	Society
	The initiative might contribute to a better image of science in society.
	Democracy
	Further long-term effects on **democracy** and **economy** have not been identified yet. However, one could speculate about the effects the SMC might have on democracy and economy. Generally, well-informed citizens and policy-makers should be expected to make **more informed decisions** with regard to research and innovation issues as additional knowledge enables them to weight possible risks and benefits more rationally. Secondly, information is often considered a prerequisite for public engagement, for instance in policy agenda setting.
	Economy
	Concerning the **economic impacts**, one might argue that better information leads to higher acceptance levels of certain technologies or industries. Moreover, with concepts like open innovation and citizen science becoming more important, information may act as a prerequisite for involvement in this type of activities. These activities (especially open innovation or participatory product development) are expected to lead to broader acceptance of the developed products and services. In consequence, this might reflect in higher market shares as well as a competitive advantage for the economy in general (through the establishment of a lead market). Thus, the proliferation of scientific knowledge may stimulate economic activity and productivity.
Causal link and limitation	The mentioned effects are purely speculative at this stage and point more towards potential pathways of how the SMC could have democracy or economic impacts rather than concrete results.

11 Open Air Laboratories (OPAL)

Table 25: Analysis sheet CS11

Case number	**11**
Case title	Open Air Laboratories (OPAL).
Short abstract	The Open Air Laboratories (OPAL) Citizen Science project by the Imperial College London mobilised citizens to collect data

	about the environment through national and regional surveys, feeding into existing scientific research and demonstrating that citizens are in a position to reliably contribute to academic research. The resources were distributed equally between research activities (preparation of data collection and exploitation of results) and services (regional data collection, education and awareness raising).
Scientific discipline	Environment Studies
Industrial sector	
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	In the case study, the engagement of the public via citizen science is interpreted as the RRI activity. Numerous single activities were carried out within OPAL, but are subsumed in the project. In OPAL, five topics were chosen for data collection, education and research (soil, water, air, biodiversity, climate), comparing collected data with previous research for quality control. Surveys for citizen scientists were prepared in information packages including information booklets, items to identify, and (different by survey and depending on the information to be collected) rudimentary tools for research (e.g. plastic magnifying loops). In the project design phase of each survey, lasting about a year, clear questions for participants to understand and answer, as well as different data quality control methods (quizzes, comparison with science surveys, side experiments) that would ensure the accuracy of the responses were developed. These packages were subsequently distributed in different regions in the UK, coordinated and supervised by community scientists. To ensure effective collaboration with all sectors of the community, regional meetings and workshops, open days, training sessions, and community visits were held. Involved groups included local governments, government agencies, schools, wildlife and nature groups, communities, and volunteering organisations, all working together with the academic team.
Impacts	**Overall assessment**
	In 2011, over 200,000 people had participated in the OPAL project; 1,000 schools and 1,000 organisations had registered. By 2013, the number of participants engaged in OPAL had more than doubled (425,000 people) from 11,000 sites around the UK. Nearly 2,000 schools had registered for OPAL resources. A total of about 230,000 field packs were distributed, 50% directly to schools and 50% to the public. Within this context, it is worth observing the high participation of schools from deprived areas. Over 10% of the organisations and schools, that OPAL works with, and 6% of submitted OPAL surveys, originated from the 10% of the most deprived areas in England; 50% of participants participated for their first time in a survey and only 8% were reluctant to complete another survey. 75% of respondents said that they would try to do more OPAL surveys in the future. By 2014, OPAL had engaged more than 850,000 users. Other RRI aspects were also addressed through the findings of online questionnaires filled in by survey participants and released by the OPAL statistics team. The findings revealed: • Willingness of the participants to repeat surveys,

	• a degree of behavioural change towards the environment, and • an enhancement of skills. The groups affected included practically all participants and the appropriateness of measures for output and outcome depend on the point of view of the three benefitting communities: • The research community because of the data received. • The wider public because of access to knowledge (engagement). • Children at school because of their increased interaction with nature (education and open air activities). Can Citizen Science contribute to RRI? It has long been acknowledged that governments alone cannot resolve the big environmental challenges facing society today[35] and Citizen Science may be a significant means to help. Hence, certain important features identified by the project need to be discussed here: • Citizen involvement in research seems to be appropriate only for research associated to societal challenges, not in corporate research of direct economic interest. • Citizen Science contributes to a selection of topics that is more relevant to everyday life. • People can exercise their influence on research agendas when they are informed and inspired. This has to be done through sparking awareness and interest. Community groups have to see the relevance of their own activities and interests in the bigger picture. • Citizen involvement is a lot more than data collection: The activities encourage participants to also think about the conditions of the project they are collecting data for (in the case of OPAL conditions that animals, plants and fungi need for survival). • Citizen Science can offer new ground for research topics as one can use the characteristics of the citizens involved for additional research (e.g. combine results with levels of poverty and other independent variables). • A challenge for Citizen Science is its continuity. An interesting point for discussion is the extent to which Citizen Science (through publicly available results) can contribute to research integrity.
	Society
	The project allowed for significant new insight into methodologies and ideas on the design and quality output of Citizen Science: the five surveys used different methods for data quality and their comparison and discussion raised new research topics on alternative approaches to data quality control (quiz, side experiments, monitoring), addressed data cleaning problems and the use of cross reference questions ex ante to facilitate quality control ex post. • Prove of Citizen Science's scientific value. • Dissemination of knowledge gained through the project to the wider public. • Participants indicating that they became more careful with their interaction with nature after having participated in the project.

[35] Office of the Deputy Prime Minister (ODPM) (2006). *Securing the future: delivering UK sustainable development strategy*. Retrieved 27 March 2015, from https://sustainabledevelopment.un.org/content/documents/1408uk.pdf

	• Teachers using the OPAL material for their classes. • Internal surveys demonstrate that citizens benefitted greatly from their participation. Societal impacts were important in terms of education and environmental consciousness: *Environment:* • A change of the behaviour of people towards the environment was observed, with 43% of people taking part in the surveys having declared that they had changed the way they thought about the environment and more than a third (37%) declaring they will change their behaviour towards the environment. Overall, the programme engaged 500,000 people directly and 500,000 people indirectly through the OPAL portal and iSpot. A total of about 230,000 packs were distributed. • An improvement of the awareness raining regarding the environment, was observed since OPAL worked with more than 1,000 organisations from the voluntary sector (53%), the community sector (38%) and the statutory sector (9%) and 46% of OPAL grant-funded societies have increased their membership by more than 10% due to OPAL works. *Education:* • An enhancement of personal skills was also observed with 90% of survey participants claiming they had learnt something new and 83% of participants reporting that they had developed new skills. • Training of a new generation of environmentalists through education of teachers and pupils on environmental issues and offering the opportunity for lessons outside the classroom. Schools participated by more than 54% in the surveys and schoolchildren alone contributed data from approximately 15,000 sites. OPAL also raised membership of environmental societies (10% increase in about 10 societies in 2010); • Outreach to impoverished parts of England through the participation in surveys of people from disadvantaged groups (learning and physical disabilities, homeless individuals, immigrant communities, illiterate, black and ethnic minority groups). In total, over 100,000 people from deprived communities participated in the surveys. • Enhancement of academic curricula and the provision of new educational materials in the 10 universities participating in the programme and in youth organisations: • The CREST Star Investigations Programme, ran by the British Science Association, was enriched by activities sent from OPAL to 785 schools and club members of various clubs that joined the programme. Pupils were also assisted by OPAL survey material. • Over 40 clubs, scouts, and guides have used OPAL Surveys and contributed data, with a greater interest in climate and weather, while OPAL sponsored the relaunch of the Scout Association's Weather badge and helped more than 150 young people to complete their Weather badge. • In 2011, OPAL was invited by Catch 22, a support organisation for young people, to be part of National Citizen Service, a government initiative and pilot scheme. • All OPAL surveys have been promoted by National Geographic Kids Magazine. The magazine also launched an environmental competition for young people and OPAL provided the awards.
	Democracy
	The project had no influence on democracy, unless one wishes to measure the contribution of education to democracy. In

	particular, people involved in the project management hope that the beneficial role of OPAL in deprived areas may have a positive influence on civic behaviour.
	Economy
	OPAL generated new knowledge from areas, which were inaccessible in the past and offered an overview of the environment that professional scientists alone could not have provided. The wide public provided data from previously inaccessible areas by scientists (gardens, inner city areas, allotments and playing fields) from all over the UK. A pertinent indicator for the additional coverage would be the share of territory covered by OPAL compared to the share of territory covered by corresponding scientific surveys but this was unavailable. High quality materials were used to study biodiversity, climate, water, air, and soils (qualitative appraisal of the research coordinators after data cleaning and quality control). Data could be collected in much more cost-effective ways than if scientific instruments and professionals were used. Again, comparable quantitative data were not available. The tool Indicia has been adapted for use in Europe: Indicia was developed as an open source software and therefore can be used and adapted by anyone, anywhere in the world. The software has been implemented in Italy by the Museum of Natural History of the Maremma and in Paris by the Natural History Museum, proving the viability and value of the software beyond England's borders. In monetary terms direct benefits included: • Over GBP 220,000 were awarded to amateur natural history societies through the OPAL Grant Scheme. • Projects have been fortunate to benefit from the in-kind contribution for the whole of the portfolio, including support and services of volunteers, institutional staff, and other organisations, which amounted to GBP 1,304,395. Economic benefits were mainly indirect, long term, and associated with: • Benefits expected from academic research, in particular the influence these research activities have in influencing the adoption of regulation (e.g. European Union Soil Directive). • The declaration of farmers that they are now more interested to check their land. • Suggestions from the community for new research topics: invasive crayfish and a new project on waste management.
Causal link and limitation	Direct causal links can only be found at a small-scale level concerning very specific activities. • The entries of new data for the researchers: approximately 25,000 surveys were submitted to the OPAL database. • The number of Master's and PhD theses resulting from the project: while there are no systematic statistics collected in this topic, in all interviews it was mentioned that both in the context of the research teams preparing and assessing the surveys as well as in the case of Community Scientists, Master's (in the Soil area alone there were 16 Master projects associated with OPAL) and PhD students were hired (2-3 per area, although this is a wild guess). OPAL has also funded 10 postgraduate PhD students. • The peer-reviewed scientific publications that were prepared based on the specific project were not systematically

	collected in the project website. However, through the interviews six scientific publications in journals with high impact factors were collected. There is a general perception that many more publications were prepared and published by the 15 associated universities but there is no OPAL repository of project-supported publication. Hence, the data on publications may be underestimated.
Discussion/Limitation of data	
Overall assessment of data quality	Quantitative data from the monitoring process of the OPAL project and qualitative data based on interviews were used to get a better insight into the project. The project started in 2007, therefore a lot of information and statistics were available online and in reports. The project itself had a monitoring and evaluation task to identify and report the indicators relevant for the funder, BLF. These are mainly the indicators referring to the community engagement and project spending. These data was made available. There was a very systematic data collection of outputs by the monitoring team of OPAL, as a Monitoring Report was one of the deliverables of the project. However, research output was not in the direct interest of the funding organisation, hence the data closely monitored were related to education, community participation, and involvement. Hence, data on direct output for research purposes was discussed during the interviews. Additional data regarding environmental awareness raising, life style changes and open-air activities was systematically collected by the project team and suggests that OPAL has created an increased interest in science and research that is expected to lead to spillover effects. However, the data on research and the impact OPAL had on the research results was more relevant for MoRRI. As these were not systematically reported but of interest to the individual research teams the input for the case study was complemented with desk research, relevant publications, and interviews with the coordinator and selected project directors. • Quantitative, regarding the level of inputs (funding, human resources involved in the project implementation), community engagement (number of people involved on a voluntary basis) and research output (publications). • Qualitative, regarding the governance of the project and the quality of results obtained.
Possible indicators	The input data of the projects is composed of: • The number of participants in the surveys, analysed into individuals, schools and organisations. • The number of Master's and PhD theses resulting from the project. • The number of packs produced for the surveys. • The number of surveyed sites. • The peer-reviewed scientific publications that were prepared based on the project. • Citations. • Visits on project websites/download of resources/use of material. • Media coverage.

12 National Open Access Policy in the Netherlands

Table 26: Analysis sheet CS15

Case number	**12**
Case title	National Open Access Policy in the Netherlands.
Short abstract	This case study examines how the Netherlands is organising the governance of Open Access publishing. The national policy aims at 100% Open Access publishing. Transition to Open Access publishing involves disruption and realignment of numerous situated practices and procedures among diverse stakeholders such as: researchers, peer reviewers, journal editors, university libraries, research funding agencies, and indeed journal publishers. *The case study does a quantitative baseline analysis of OA publications in the NL, measures the OA output and development of OA publishing, but does not analyse any related benefits for society, democracy, or economy. Increased OA is taken as a benefit as such.*
Scientific discipline	
Industrial sector	Publishing sector
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	OA journals
Impacts	**Overall assessment**
	• The share in output in OA journals is lagging behind compared to the journals that maintain the non OA format. • OA journals have lower journal impact scores than non-OA journals. This may mean that they still struggle to find their position within the total "reputational hierarchy" of the domain. This is a common problem for new journals and OA journals are no exception. • We observe for the three countries that the share in output in OA journals is lagging behind as compared to the journals that maintain the non-OA format. We observe a divergence in the development of citation impact for (Gold) OA and non-OA publications with consistently lower impact for the OA publications in the last time frames as compared to earlier periods (where impact of OA publications were more or less similar to non-OA publications). • Second, we observe that OA journals have lower journal impact scores than non-OA journals (data not shown). This may mean that they still struggle to find their position within the total "reputational hierarchy" of the domain, and as such also within the Web of Science (WoS) database. This is a common problem for new journals and OA journals are no exception.

	Society
	Democracy
	Economy
Causal link and limitation	Please note that the conclusions from our quantitative analysis are mainly related to the domains in which journal publishing is the dominant way of communication (the natural, life, and medical sciences, and to a much lesser extent the social sciences and humanities (van Leeuwen, 2013). While the current political discussion mainly centres around journal publishing, and the publishing industry slowly moves towards finding ways to operationalise OA journal publishing, issues related to the OA publishing of books is far less well developed.
RRI activity/measure II	
Description of RRI activity	Association of Universities in the Netherlands (VSNU) is central in coordinating **implementation of the national OA policy**. This includes establishing a project manager to coordinate among stakeholders regarding ongoing negotiations with journal publishers and development of new infrastructural resources to support the transition to OA publishing. *The OA policy is taken as input activity.*
Impacts	**Overall assessment**
	No effects assessed
	Society
	Democracy
	Economy
Causal link and limitation	
RRI activity/measure III	
Description of RRI	Open Access is operationalised in various ways by the publishing industry and there are various license types related to

activity	Open Access. There is no clear way of operationalising in the larger databases of the various business models (such as Gold, Green, and Hybrid Open Access). To address this, the Netherlands created a **simplified Open Access definition framework**, coinciding with implementation of new current research information systems (CRIS) at Dutch universities and research institutes. This deployment of institutional CRIS systems provides an opportunity for national level tracking of Open Access through coordinated deployment of the definition framework and common registration practices. However, the Dutch approach deviates from a recently published metadata standard for Open Access: the NISO (2015) standard specifies metadata elements for free to read and license reference.
Impacts	**Overall assessment**
	Society
	Democracy
	Economy
Causal link and limitation	
Discussion/Limitation of data	
Overall assessment of data quality	The study involves interviews of key stakeholders, document analysis, and a baseline quantitative analysis of Open Access publications in the Netherlands. A crucial aspect of implementing the national OA policy is the ability to monitor progress on a regular basis. This case study incorporates both quantitative and qualitative approaches. First, a baseline analysis is conducted to (a) establish the proportion of Open Access journal articles produced in the Netherlands and (b) assess the efficacy of using a commercial bibliographic database (WoS) for monitoring Open Access. Second, interviews and document analysis are used to assess activities associated with implementation of the Open Access policy. In addition, we use document analysis and semi-structured interviews to identify mobilisation of Dutch stakeholders and material resources associated with enabling Open Access, but that is not apparent from the quantitative analysis. The documentary analysis is focused on the implementation of Open Access policy and associated infrastructure development. Interview subjects include stakeholders from the Ministry of Education, Culture and Science (OCW), the Association of Universities in the Netherlands (VSNU), and journal publishing. The objectives of the quantitative analysis are to establish a baseline of Open Access output in the Netherlands as

	measured with commercial bibliographic data, and in so doing to identify the challenges and limitations. The WoS database is used in its internet version, available to most Dutch researchers. We also used a modified version of the WoS data, prepared by the Centre for Science and Technology Studies (CWTS) at Leiden University. This CWTS dataset allows for advanced bibliometric techniques and indicators. In this version, the functionality to search for OA output is not yet available. Finally, we make use of the journals and the publications listed in the Directory of Open Access Journals (DOAJ). From this data source, we focus on the digital object identifiers (DOIs), while leaving out other elements (such as the license types, as this information is unclearly defined as well as unclearly linked to the publications). Two analytical approaches are compared. Data collection and analysis consists of a direct linking of DOAJ (Directory of Open Access Journals) listed journals, in a double linking process. First, by using the ISSN of the journal as the matching principle between the DOAJ list and the WoS database, and second, by using the start year of the journal in the DOAJ list (the year of becoming Open Access) as simulation of the publication year. As the data sources we use are incomplete with respect to Open Access publications, the analysis is focused on comparison of relative output and relative impact among three European countries of similar size and scientific production: the Netherlands (NL), Denmark (DK), and Switzerland (CH), in order to show developments in time, as well as differences resulting from both approaches. A third conclusion relates to the messy situation around the various manners by which Open Access is defined in electronic databases. The two different ways Open Access can be operationalised within the world of WoS is an example of this unclear and somewhat messy situation. The fact that the Scopus database did not have the functionality to clearly define Open Access for users of the system is another expression of the unclear situation around Open Access. Further examples of this unclarity are the various ways Open Access is operationalised by the publishing industry. There is no clear way of operationalising in the larger databases of the various business models (such as Gold, Green, and Hybrid Open Access). Yet another example relates to the various license types related to Open Access. *The case study uses a lot of diverse and comprehensive data, but again, only measures the OA policy and the development of OA publishing. Impacts or benefits are not assessed.*
Possible indicators	• Numbers of OA publications (P) • MNCS (Mean Normalized Citation Score) of OA publications • MNJS, the field normalised journal impact indicator of OA journals • Normalised impact scores of OA journals compared to non-OA • Share in output in OA journals compared to journals that maintain a non-OA format

13 Participatory action research (PAR) in environmental management

Table 27: Analysis sheet CS13

Case number	**13**

Case title	Participatory action research (PAR) in environmental management
Short abstract	The case study features a research project whose aim it was to test and develop Participatory Action Research (PAR) as a radical "deep" participatory approach that might allow communities to harness their local knowledge and feed this into environmental policy frameworks to effect change. The use of PAR, here in the case of river catchment management, was a ground-up, open-ended collaboration in knowledge production with members of a charitable river protection organisation in the UK working as equal partners throughout the research process, and it was the first in the UK. This focus arose from the growing imperative for participation and public engagement in environmental management and the fact that many existing approaches were limited in their levels of participation.
Scientific discipline	Environmental Management and Planning
Industrial sector	Agriculture
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	This case study features a research project, which applied a critical alternative framework for science and knowledge production, namely Participatory Action Research (PAR). PAR consists of collaborative research, education, and action used to gather information for change on social or environmental issues. It offers an alternative mode of science, involving collaboration and co-production of research from question definition through to outcomes (Pain et al., 2012). A research team from Durham University, in the framework of the UK's Rural Economy and Land Use Programme[36], implemented the research project entitled *"Building Adaptive Strategies for Environmental Change with Rural Land Managers"* from 2010 to 2012. The objective was to test and develop PAR as a radical "deep" participatory approach for integrated river catchment management.[37] The approach was sought to allow communities to harness their local knowledge and feed it into environmental policy frameworks to effect change. The use of PAR in river catchment management – a ground-up, open-ended collaboration in knowledge production with members of the Lune Rivers Trust

[36] Interdisciplinary research was funded between 2004 and 2013 in order to inform policy and practice with choices on how to manage the countryside and rural economies. The programme enabled researchers to work together to investigate the social, economic, environmental, and technological challenges faced by rural areas. It was an unprecedented collaboration between the Economic and Social Research Council (ESRC), the Biotechnology and Biological Sciences Research Council (BBSRC), and the Natural Environment Research Council (NERC). It had a budget of £24 million, with additional funding provided by the Scottish Government and the Department for Environment, Food and Rural Affairs. Website: http://www.relu.ac.uk/

[37] Integrated catchment management is a subset of environmental planning which approaches sustainable resource management from a catchment perspective, in contrast to a piecemeal approach that artificially separates land management from water management. Integrated catchment management recognises the existence of ecosystems and their role in supporting flora and fauna, providing services to human societies, and regulating the human environment. Integrated catchment management seeks to take into account complex relationships within those ecosystems: between flora and fauna, between geology and hydrology, between soils and the biosphere, and between the biosphere and the atmosphere. Integrated catchment management recognises the cyclic nature of processes within an ecosystem, and values scientific and technical information for understanding and analysing the natural world (Wikipedia; accessed 29 February 2016).

	working as equal partners throughout the research process – was the first in the UK (Pain et al., 2012).
Impacts	**Overall assessment**
	The research project concluded that co-production should be reframed as the circulation of expertise, and argued that PAR can enrich the learning, knowledge and skills of all those involved and lead to innovation and positive environmental outcomes. It furthermore recommended addressing a number of structural and institutional barriers to deep participatory processes (Whitman et al., 2015).
	Society
	• Higher openness towards new approaches to environmental management in society. • Higher levels of knowledge about academic disciplines in general and the problematic in question in particular. • The power relationships that often characterise research were challenged. While according to the researchers it was not possible to completely dismantle these, they strove to create a process where the usual hierarchies around whose knowledge and expertise counts were broken down (Whitman et al., 2015).
	Democracy
	PAR has a specific notion of co-production - both in principle and in practice; all partners work collaboratively at every stage of the research to forge new ideas and results. Overall, the following positive impacts on democracy which are usually documented could also be found in the project at hand: • Citizens and local administrators can make more informed choices. • Citizens can participate in political decision-making. Specific impacts for the three main stakeholder groups from the PAR project in question are documented as follows: • Locals/LRL members: The locals were knowledge producers, they contributed to solving of concrete problems at the local level. For them the impacts consist of democratic deliberations and democracy gains. The LRT members felt that their knowledge and expertise were respected and placed centre-stage in the research process. The Lune Rivers Trust also gained greater capacity to use the tool SCIMAP, and gathered experience of conducting PAR (and to also use to collaboratively developed PAR Toolkit). They also received the Farm Vulnerability Tool, which they are already using in their work in the catchment. • Researchers: Rethinking participation: wider contributions have arisen from the research process on the nature, potential and limitations and role of participation when used on issues that involve traditional ("hard") science and are more often approached in a technocratic manner. Overall, the researchers learned more about PAR principles and techniques. The capacity of all three researchers to work on further interdisciplinary projects was enhanced by this training, and by experience and dialogue throughout the project. The developed publications benefit the wider research community (3 peer-reviewed publication, 5 conference papers, 2 conferences organised, 2 guidelines). More widely, the project has fed into extending understanding and building capacity amongst (a) postgraduates and early-career researchers at Durham University working on related topics involving participation and science, as they attended and took part in the final project workshop; (b) other researchers on related RELU projects, through discussions, meetings and the final RELU conference in November 2011. • Policy-makers/local authorities: they can use the guidelines developed for future similar activities.

	Economy
	The economic impacts that arose through the application of the newly developed tool at the local level, which aims to solve a concrete issue in environmental management, were not quantified by the project managers. However, the PAR approach used led to outcomes that could not have been brought about by traditional research methods alone; the collaboration with local experts was crucial. As such, impacts that could be expressed in monetary terms include for instance the fact that the project identified which farmyards were more vulnerable to slurry reaching watercourses. This in the long run could lead to adaptations and monetary savings.
Causal link and limitation	Economic impacts are seen as likely but have not been quantified in the featured project.

14 Nanotechnology RRI in the Netherlands

Table 28: Analysis sheet CS14

Case number	**14**
Case title	Nanotechnology RRI in the Netherlands
Short abstract	In June 2008, The Dutch government published the "Actieplan Nanotechnologie". The Action Plan gives a description of the national nanotech policy. The plan presents the opportunities and a research agenda and addresses the potential risks of nanotech and the ethical aspects, social dialogue, and communication on nanotech in the Netherlands. In the plan, two activities were announced that can be considered as a means of integrating "responsible research and innovation" (RRI) in the plan. The focus of the case study is on the economic effects on companies participating in public organised/funded RRI activities. The RRI activities of Nanopodium, the public debate on nanotechnology, and of NanoNextNL, a research programme explicitly addressing RRI through three different instruments, are discussed.
Scientific discipline	
Industrial sector	Nanotechnology
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	**Nanopodium**, a public debate about Nanotechnology, organised by the Committee Societal Dialogue Nanotechnology from 2009 to 2011. The position and mission of the Committee were: providing a place/the means for the dialogue and publishing opinions on nanotechnology, but not interfering in or influencing the dialogue. In July 2009, a working conference was organised with experts and stakeholders that – together with interviews with various stakeholders – was an important input to the agenda for the public dialogue that was launched in a public opening event in September 2009. Based on this agenda, individuals and organisations were invited to submit ideas for projects

	through which the public dialogue should take place. The selection of project proposals led to the selection of 35 projects: • 16 for delivering publications, TV programmes, YouTube, teaching materials, etc., • 3 for exhibitions, artists impressions, etc., • and 16 for organising debates: live, online, theatre, etc. The Nanopodium activities came to a close in January 2011 with the Nano-festival in the NEMO Science Centre in Amsterdam with about 600 visitors.
Impacts	**Overall assessment**
	Society
	Democracy
	Economy
	The effect of the nano RRI activities on the companies could be measured mostly in terms of direct outputs and outcomes: • The acquisition of knowledge on the new technology and its applications. • The expansion of the company network. • Involvement into several EU funded projects (FP7, GUIDEnano, NanoReg) on risks of nanotech and nanomaterials. • The contribution to a development (social opinion forming on nanotech and its risks) that affects the company now and in the future. • Due to the Nanopodium debate, the company is still running and is running well. Referring to the Committee and the Nanopodium dialogue gave a certain authority and credibility to their presentations and made it rather easy to find new clients and agents. The head of the company states rather explicitly that in case there would have been no CoSDN and no Nanopodium debate, his company would not have survived.
Causal link and limitation	Each cost/benefit analysis of the involvement of the company head in the debate and what it has brought his company would show a negative outcome, as the costs – in terms of time spent on participating in the debate and preparing and giving lectures – are very high. This means that purely from a cost/benefit perspective hardly any small company would participate in public debates and projects: it costs too much time and the benefits cannot be measured. However, the Nanopodium debate and the company's participation in it had a positive effect on the company, but this cannot be measured in a quantitative (Euro-wise) manner. Economic impact of RRI in nanotechnology is hard to measure in currency, profits, growth of GDP, or similar. These types

	of economic impacts of RRI mostly materialise in the long term, and they are hard to pinpoint directly to RRI (attribution problem). In this case, study economic impact was measured in terms of the number of business cases and start-ups, in improved marketing, strategy, or business operations and in company survival.
RRI activity/measure II	
Description of RRI activity	**NanoNextNL** is the largest innovation programme in the Netherlands and has a budget of 251 million Euros over the period 2011-2016. The Dutch Ministry of Economic Affairs funds half of the budget; the other half is provided by the academic (25%) and industrial (25%) partners. Its mission is "to accelerate the creation of durable economic and social value by developing and commercializing innovative nano and microtechnology, and by forming a sustainable ecosystem of researchers, entrepreneurs and policy makers". The NanoNextNL consortium – in which academia and industry collaborate – consists of 130 partners (30 from academia; 100 from industry) (NanoNextNL, 2013). The research within NanoNextNL covers nearly all nanotechnology domains. It consists of 10 themes, 28 programmes and 235 projects. **Risk Analysis and Technology Assessment (RATA)** is a theme that is cross-cutting all other areas. The RATA theme includes three research programmes: Human Health Risks, Environmental Risks and Technology Assessment of nanotechnology. Two other RATA activities are the two-day RATA course (The two-day RATA course is part of a broader set of RATA education, which also entails coaching, intervision groups and teaming with professionals to help PhD students to better deal with RATA aspects.) and the valorisation programme with embedded RATA aspects. About 15% of the total NanoNextNL budget is invested in the RATA theme, amounting to 21.2 million Euros. Two companies are involved in the RATA risks research, and they match the government funding with 1.6 million Euros. Three RATA activities are discussed: • the research within the RATA theme (risks and TA); • the two-day RATA course; and • the RATA activities incorporated in the valorisation programme. *(See below for those points as single activities.)*
Impacts	**Overall assessment**
	• Insight in risks of nanomaterials is important for authorities, society and industry to make nanotechnology successful and to thrive successful innovations.
	Society
	Democracy
	Economy

	• NanoNextNL created awareness for RRI among academic and industry partners through its RATA theme and course, created business cases in which RRI aspects were explicitly addressed, eventually resulting in start-ups that could be termed responsible. • The two companies in the risk analysis part participate partly from a marketing interest: they like to profile themselves as responsible and sustainable.
Causal link and limitation	
RRI activity/measure III	
Description of RRI activity	The RATA theme focuses on **research** about human health risks, environmental risks and technology assessment. It includes 25 projects, such as "Anticipating on technological developments and their embedding in society", "Governance of responsible development of nanotechnology" and "Society's response to nanotechnology". The total budget of the RATA theme is 21.2 million Euros. In the RATA theme, the technology assessment part is only financed by the governmental and academic partners, while the two risk analysis parts are matched by both public and private partners. Two companies are involved in the RATA risks research, and they match the government funding with 1.6 million Euros. The two companies in the risk analysis part participate partly from a marketing interest: they like to profile themselves as responsible and sustainable (NanoNextNL, 2013; Vandeberg, 2016).
Impacts	**Overall assessment**
	Society
	Democracy
	Economy
	• During the first three years, at least three business cases have been developed . • No start-ups have been realised yet. • One patent has been filed.
Causal link and limitation	
RRI activity/measure IV	
Description of RRI activity	NanoNextNL regularly organises a **RATA course** on the importance and basics of risk analysis and technology assessment in nanotechnology. This two-day course is open to all involved researchers and entrepreneurs, and interested

	externals. It is organised by an external company bureau in close cooperation with NanoNextNL and its RATA experts. The costs for NanoNextNL partners (750 Euros per person) are covered; the participants must pay for accommodation and meals through their project budget. The course focuses on the purpose, relevance, art, and application of RATA in nanotechnology research and innovation. **Coaching** is available during and after the course to address RATA aspects in the research and thesis of PhD students, which is mandatory to address in all themes (NanoNextNL, 2016, 2015b).
Impacts	**Overall assessment**
	Society
	Mostly PhD students have participated (and used it for successfully addressing RATA in their theses). They learned the basics of risk analysis and technology assessment.
	Democracy
	Economy
	Only one company has attended the course so far, although by accident. In hindsight, the company participant found the course interesting, it was useful for addressing nano aspects in the company's product sheets, which is notoriously difficult. He also considered using another material for their solar cell product: one that has a slightly reduced performance, but has much less associated risks. Awareness for RATA has thus been created.
Causal link and limitation	
RRI activity/measure V	
Description of RRI activity	The **valorisation programme** also includes RATA aspects. So far, 2.5 million Euros have been allocated to the programme (two calls). The programme consists of five stages in which applicants can improve their business case; in each stage, applicants can drop out. In the first stage, the Lean Business Model Canvas, includes a "Safety and Society" item, both aspects have to be rated (using a system similar to the European energy labels – A to E). In the second stage, a commercial online business tool – "the Golden Egg Check" – is used to rate several aspects of the business case, including RATA aspects. As the next three stages build on the first two, the RATA aspects will be recurring in later stages. Here also a Life Cycle Analysis (LCA) is done (NanoNextNL, 2015a). In the first call (summer of 2014), 40 applicants received some sort of business support. Out of those, 16 applicants were awarded 125,000 Euros after having successfully finished the fifth stage for improving their business case. The second call (summer 2015) with a similar number of applicants had a slightly smaller budget, awarding 100,000 Euros in the end to each successful participant (NanoNextNL, 2015a).
Impacts	**Overall assessment**

	Overall, it can be concluded that RATA activities had a number of "economic" short-term results. In the long term, all industry partners benefit from RATA, in terms of acceptance and clarity about risks.
	Society
	Awareness for RRI has been created, first of all among PhD students and the participants to the valorisation programme. Furthermore, RATA has been disseminated to the other partners through the annual RATA day and the attendance at other theme meetings. This has led to at least some awareness for RATA aspects among industry partners.
	Democracy
	Economy
	• Researchers and innovators who had ideas for valorisation through business development were affected. They explicitly had to address RATA aspects in the process of starting a new company. This has led to lean business model canvasses that address safety and society. So far, the RATA aspects have not been a reason for an applicant to drop out during the valorisation programme, there were no RATA aspects found that would hamper a potential successful business. • Technology assessment has proven to be very useful as a strategy instrument in analysing business cases and thus led to stronger business cases for potential start-ups.
Causal link and limitation	
Discussion/Limitation of data	
Overall assessment of data quality	The methodology for this case study is based upon interviews and desk study. Two semi-structured interviews were held; one with a company director who participated in Nanopodium and one with the RATA programme officer of NanoNextNL. This provided us with the perspective from a Dutch company participating in nanotech RRI and the perspective of a Dutch nanotechnology programme office that aims to involve companies in nanotech RRI. For the desk research, we used several sources of which the majority is provided by Nanopodium and NanoNextNL. For NanoNextNL, we used the Midterm Self Evaluation Report (2010-2013), thematic brochures, website, and data provided by the interviewee (Vandeberg, 2016). NanoNextNL measures the impact of the programme; for this, it has defined several Key Performance Indicators (KPIs) and associated targets. Also for the RATA theme impacts are measured. For the case study, the following "economic" KPIs are relevant: the number of patent filings, the number of business cases, the number of start-ups created, the number of RATA public events. Additionally, budgets and numbers about the participation in the NanoNextNL Valorisation programme and the RATA course were found to be relevant in measuring the RRI impacts of NanoNextNL. The quantitative figures for NanoNextNL were measured by NanoNextNL itself for their own management purposes. The quality and the reliability of the data is considered to be good and in line with those mentioned during the interview,

	although the figures are not the most recent (mostly from November 2013 as figures are currently updated for the period up to 2016).
Possible indicators	• Number of patent filings. • Number of business cases. • Number of start-ups created. • Number of RATA public events.

15 Infineon Technologies

Table 29: Analysis sheet CS15

Case number	**15**
Case title	Infineon Technologies
Short abstract	The case is about activities in the area of RRI, which are undertaken at the level of an individual company. The focus is laid on the company's understanding of RRI, activities implemented, and measures used to evaluate the output and impact of RRI activities. The analysis of the data shows that activities related to ethics, gender equality and diversity as well as to Open Access and participation (or cooperation) are realised. Most of the actions identified are implemented as part of the CSR policy of the company. For those actions, also a number of indicators and calculations exist to demonstrate their societal and environmental impact. Indicators to evaluate the benefits of activities related to other dimensions of RRI (for example gender equality) are less developed. The case shows that efforts already exist to make RRI activities measureable.
Scientific discipline	
Industrial sector	Semiconductor
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	CSR Policy: A general objective of the company is to help mastering grand challenges like energy shortage, limited resources, population growth, etc. The idea behind this objective is that only by generating value for clients and society in general the company can be economically successful. Economic success also depends on fulfilling demands from clients related to RRI. Clients request a clean supply chain and sustainable raw materials. These requests have to be followed by the company, as incompliance would lead to business loss. Requests related to ethical questions can also come from the staff, e.g. in one case, employees explicitly asked the company to distance itself from the defence industry.

	In the company, there is a Corporate Social Responsibility policy in place. This policy comprises voluntary commitments in the areas of human resources management and human rights, environmental sustainability, occupational safety and health, corporate citizenship, CSR supply chain management as well as business ethics. The company is listed in the Dow Jones Sustainability Index and it is member of the UN Global Compact.
Impacts	**Overall assessment**

	Generally speaking, the company engages in activities that seem useful to generate value clients are ready to pay for. This means that the perceived demand is used as an indicator or measurement of the benefit of RRI activities. Activities to enhance energy efficiency were mentioned as an example for activities clients are willing to pay for and are carried out by the company.
	Output and impact measurement is most developed regarding CSR activities. In the Annual Report 2015, various goals, measures, and results related to the CSR activities of the company are stated. Indicators to assess the impact of the activities are for example:[38]
	• Health and workplace security:
	  ○ Injury rate: for 2015: 0.46; Calculation: total number of injuries/total hours worked x 200,000; holidays and public holidays are included in the working hours.
	  ○ Lost day rate: for 2015: 5.65; Calculation: total number of lost days/total hours worked x 200,000; holidays and public holidays are included in the working hours.
	• Environment:
	• Water consumption: for 2015: about 21 million cubic meters of water.
	• Waste generation: for 2015: 32,940 tons.
	• Energy consumption: for 2015: 1,467 gigawatt hours.
	• CO_2 burden: for 2015: 1.6 million tons of CO2 equivalents; the calculation of CO_2 emission is based on the ISO 1400 standard39 substantiated by the PAS 20150 guideline.[40]
	As (very crude and in fact not directly attributable) indicators for the benefit of adhering to **ethical principles**, the market position or the market share is used.

	Society
	Regarding the **societal impact** of the company there have been some attempts to measure this impact. In the interview, it was referred to a study on Austrian leading companies from Schneider et al. (2013). In this study it was shown that • Leading companies cooperate with about 900 SMEs.

[38] All indicators refer to Infineon Technologies AG.

[39] http://www.iso.org/iso/iso14000 (accessed 8 February 2016)

[40] http://shop.bsigroup.com/upload/shop/download/pas/pas2050.pdf (accessed 8 February 2016)

	• Furthermore, the **purchasing volume of Infineon** (not publicly available) and the **work places generated** (for example 3,000 in Villach) were suggested at indicators for the company's societal impact. • It was also mentioned that due to the internationality of the staff the company has an **impact on tourism**. However, this impact was not calculated yet.
	Democracy
	Economy
Causal link and limitation	In general, the quality of the data is limited and information regarding the effects of RRI related activities is sparse. Furthermore, only limited approaches within the company to measure the impact of RRI activities quantitatively exist.
RRI activity/measure II	
Description of RRI activity	**Gender equality and diversity:** Infineon promotes diversity as part of its H&R policy. Diversity includes the dimensions gender, internationality, and age. The company has set the goal to have 20% female executives at the international level and 15% female executives in Austria by 2020. To support international employees, three specific measures have been taken: the foundation of an international club, which supports new employees, the provision of international day care, and the establishment of an international school.
Impacts	**Overall assessment**
	The benefits of diversity are not directly measured. However, the company believes in the benefits of a diverse team. As a very general indicator for the benefits of diversity the business performance was suggested (for example: revenue 2015: € 5.795 million; gross profit 2015: € 2.080 million). To measure the impact of activities related to gender the share of female employees is used (16% in 2015 for Infineon Austria). The following two indicators are used to evaluate the success of measures implemented in order to promote internationality: staff departures (2015: 3,048 for the Infineon group) and turnover rates (worldwide employee turnover rate 2015: 9.0%; calculated based on the monthly workforce in the 2015 fiscal year).
	Society
	Democracy
	Economy

Causal link and limitation	
RRI activity/measure III	
Description of RRI activity	**Open Access and participation:** Clients are involved in the innovation process in order to provide solutions to their needs. Moreover, the company cooperates with research institutes and partner organisations. In Austria, about 25% of all research and product development projects are conducted with external partners.
Impacts	**Overall assessment**
	Related to **Open Access and cooperation** there is a (mainly qualitative) monitoring of research partners in place. How well the cooperation with partners functions is measured in the time needed to identify a suitable partner and to set up a contract with him/her.
	Society
	Democracy
	Economy
Causal link and limitation	
Discussion/Limitation of data	
Overall assessment of data quality	
Possible indicators	

16 AVL List GmbH

Table 30: Analysis sheet CS16

Case number	**16**
Case title	AVL List GmbH

Short abstract	The case is about activities in the area of RRI, which are realised at the level of an individual company. The focus is laid on the company's understanding of RRI, activities implemented, and measures used to evaluate the impact of RRI activities. For the collection of the data, a semi-structured interview, informal information from the environmental manager, and publicly available information were used. The analysis shows that activities related to ethics, gender equality, environmental impact and Open Access are realised. Most activities can be found in the area of sustainability and reduction of the environmental impact of the company. Regarding these activities, attempts to measure their impact also exist.
Scientific discipline	
Industrial sector	Automotive
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	The company has introduced a compliance guideline, which addresses ethical aspects in the interaction with partners and clients. The compliance guideline focuses on the business processing. Its provisions include no bribery, no acceptance of gifts, and no distortion of competition. The guideline was introduced as ethical aspects are important in the view of the management.
Impacts	**Overall assessment**
	Regarding ethical aspects there is no intention or approach to measure costs and benefits. In general, it can be said that until now there have been little attempts to measure outputs or impacts of RRI activities. RRI is rather described as something inherent to the business purpose and something that does not need to be justified by numbers. For example, the business purpose was defined as the improvement of powertrain systems in order to reduce energy consumption and negative impacts on the environment. This was said to be already a contribution to sustainable development. Furthermore, high ethical standards were described as central to the corporate culture. In both cases, outputs or impacts are not calculated.
	Society
	Democracy
	Economy
Causal link and	Regarding the quality of the data, it is problematic that due to confidentiality issues not all internal data/guidelines could

limitation	be obtained. Furthermore, only limited approaches within the company to measure the impact of RRI activities exist.
RRI activity/measure II	
Description of RRI activity	The company aims to reduce its environmental impact and to improve its energy efficiency. It meets ISO 14001 standards[41] and is part of the ÖKOPROFIT® programme[42]. The ÖKOPROFIT programme is a collaborative effort between local businesses, the public administration, and external experts with the aim to reduce emissions and preserve natural resources while reducing operational costs. It can be understood as a win-win idea and a model for sustainable economic development of a region. The AVL has the following environmental policy: • "The sense of responsibility for the environment of all employees is encouraged by means of regular trainings and information. • An objective assessment, monitoring and reduction of the effects on the environment are carried out as early as in the planning phase, during design, procurement, at the place of work and during storage. • The application and the further development of energy- and water-saving low-emission and low-waste technologies are promoted incessantly. Preventive measures for saving resources are taken, and furthermore for preventing environmentally relevant incidents and minimizing their effects on the environment (during normal and abnormal operation). • In-house rules serve to monitor the environmental management system and result in the implementation of corrective measures when the environmental objectives are not reached. • AVL List GmbH undertakes to comply with acts, directives and regulatory restrictions. • The general public (residents, government authorities, customers) is given the information necessary for a better understanding of the industrial site and its implications. The dialog with the general public and the scientific community takes precedence over confrontation. • Precautionary measures are taken to ensure that suppliers, customers and subcontractors working on site are made aware of the environmental policy applicable at the site and are requested to comply with it. • The management is required to lead by example."[43] The company has already implemented a variety of measures to reduce its environmental impact. Examples are the use of LED lights, electric vehicles for short distance drives or the implementation of a sustainable energy concept.

[41] "The ISO 14000 family of standards provides practical tools for companies and organizations of all kinds looking to manage their environmental responsibilities. (…) ISO 14001:2015 sets out the criteria for an environmental management system and can be certified to. It maps out a framework that a company or organization can follow to set up an effective environmental management system. It can be used by any organization regardless of its activity or sector. Using ISO 14001:2015 can provide assurance to company management and employees as well as external stakeholders that environmental impact is being measured and improved." (http://www.iso.org/iso/iso14000; accessed 8 February 2016)

[42] http://www.umwelt.graz.at/cms/ziel/4850005/DE/ (accessed 8 February 2016)

[43] https://www.avl.com/quality-environment-safety (accessed 8 February 2016)

Impacts	**Overall assessment**
	Comprehensive attempts to measure the impact of activities related to RRI do not exist. However, some approaches to the identification of effects or even indicators could be observed.
	Society
	Democracy
	Economy
	The most developed approach for impact measurement can be identified for the company's activities related to environmental aspects: Regarding the (economic) impact of activities to promote sustainability the following measures have been calculated and published: • Change to LED lights led to energy savings of about 60%. • Improvement of the air conditioning of the data centre led to energy savings in the area of air conditioning of 8% per month. • Installation of waste heat utilisation saved 145 mWh/a and made a CO_2 reduction of 71 t/a possible. • Optimisation of the packing of goods that has a potential to reduce the weight of package by 155 t/a. Activities of the company to promote sustainability can be described as having a general positive impact on the environment and also the society at a global level.
Causal link and limitation	
RRI activity/measure III	
Description of RRI activity	Products are developed with the input and in cooperation with the clients. The company is present in institutions such as, for example, EARPA, an association of automotive R&D organisations, where they cooperate with competitors in order to draft grant programmes and consult funding agencies. The company participates in these activities to eventually benefit from them in the form of received grants/subsidies.
Impacts	**Overall assessment**
	Society
	Democracy

	Economy
	The activities of the company related to **Open Access** also follow cost-benefit-considerations though on a less formalised basis. The company cooperates with competitors in various fora in order to benefit from these activities in the form of funds (e.g. for EU projects). An indicator for the success of such cooperative activities is the number of secured funds/received grants. However, no calculations or numbers on that could be obtained.
Causal link and limitation	
Discussion/Limitation of data	
Overall assessment of data quality	
Possible indicators	

17 FemPower Bonus for Female Project Leaders

Table 31: Analysis sheet CS17

Case number	**17**
Case title	FemPower Bonus for Female Project Leaders
Short abstract	FemPower Calls and FemPower Bonus were introduced by the Vienna Business Agency, aiming to support greater involvement of women in innovation and research projects. With the FemPower Bonus, the Vienna Business Agency provides a specific incentive to increase the share of women among project leaders. In case a woman is the leader of an R&D project funded by the Vienne Business Agency, the company will receive 10,000 Euros of additional funding.
Scientific discipline	
Industrial sector	Information and Communication Technologies (ICT), Life Sciences
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	FemPower Bonus (description see above)
Impacts	**Overall assessment**

	Society
	• Companies are asked to elaborate on potential differences in usage of an innovation for different groups already in the proposal. This leads to more diverse and targeted products and innovation. • The bonus contributes to an increasing participation of women in R&D and leads therefore to additional role models for younger generations. This should be seen as a first step towards a change of traditional roles/stereotypes. • The design of the bonus as general part of the funding process avoids negative associations with measures to promote women (Frauenförderung), such as a conflict between gender and excellence/merit. As a first step, the best-qualified projects are identified and only in the second place the sex of the project leader is taken into consideration. • Furthermore, as the FemPower Bonus is part of general research funding and calls, it is combined with gender criteria implemented in the application process. Therefore, applicants as well as reviewers have to deal with the gender dimension in the context of R&D. Thus, gender dimension is implemented at an organisational level (effecting all programmes and projects funded by the organisation) and at local level (Vienna).
	Democracy
	• The incentive increases female participation in R&D, which is a democratic effect as such. These effects appear at the level of project teams, research groups as well as at a company level. If you consider that, there are more democratic effects related to increased female participation in R&D: • The evaluation showed that with very few exceptions, those women who got positions as project managers for the first time were assigned further project management tasks and/or management functions. • Women who were already working in a managerial capacity were able to expand their departments and development activities and increase their position within the company. • It is assumed that the financial incentive makes companies think about qualified women who are willing to take up management positions. Consequently, the primarily male dominated culture in projects is thus called into question. • Thaler and Hofstätter argue that women who are as project leaders now in the position to recruit researchers bring in more female researchers and contribute to an increase in the female workforce. Experienced female project managers see this as a step to "break through the glass ceiling" (Thaler and Hofstätter, 2012, p. 19).
	Economy
	• The economic effects of the bonus have not been part of the evaluation. It seems to be difficult to identify causal effects of a measure, which is part of a broader policy mix. • However, at a qualitative level, the bonus as part of R&D funding is interpreted as an instrument to strengthen competitiveness of Viennese companies. It is assumed that greater involvement of women in research projects not only opens up new career opportunities for women but also increases the quality of projects and consequently strengthens the competitiveness of the company and therefore constitutes a competitive advantage for Vienna.

	• The bonus increases resources and brings more recognition in the scientific community and also within the company; especially in small companies, funding is an important source for research projects/business. • In 2014, 57 projects received in total 225,000 Euros bonuses because of a female project leader. The volume of projects amounted to 4,000,000€ Eurosfunding in total (Czernohorszky and Rauscher, 2016, p. 3). This is an increase compared to 2011 the year the evaluation refers to (48 projects; Thaler and Hofstätter, 2012).
Causal link and limitation	The evaluation draws a causal link between the initiative and women assigned project leadership for the first time. This conclusion is based on a qualitative study. The authors of the case study did not identify any restrictions with regard to explanatory power of evidence used.
Discussion/Limitation of data	
Overall assessment of data quality	The case study mainly refers to the evaluation of FemPower (Thaler and Hofstätter, 2012). The evaluation is complemented by a comprehensive desk research (documents, reports, homepage). In the evaluation, in total 23 researchers were interviewed: 20 of them had been project leaders of the respective projects. From the given population comprising all projects in ICT and life sciences headed by women the sample covered 60% of ICT project leaders and 69% of project leaders in life sciences. The methodology applied comprises guided interviews and questionnaire-like career data sheets. For quality assurance, the vast majority of interviews was conducted by two interviewers and all interviews were analysed by two interpreters for triangulation.
Possible indicators	• Women in project lead position. • % of working hours applying to women. • Discussion of different forms of usage of the innovation for different groups or of relevant aspects regarding diversity in funding applications.

18 Gender Criteria of the Austrian Science Fund (FWF)

Table 32: Analysis sheet CS18

Case number	**18**
Case title	Gender Criteria of the Austrian Science Fund (FWF)
Short abstract	In this case, the gender equality strategies of the Austrian Science Fund (FWF) were analysed according to their impact on the participation of women in science and research and on cultural changes on the funding practices of the FWF. With the establishment of a staff unit for gender issues, several measures to increase the awareness for gender equality in the organisation (awareness training, increasing share of women in boards and in the staff), to raise the share of female applicants (monitoring the share of women in grants, redesign of programmes), and to ensure fair and equal treatment of female and male applicants (gender equality standards for external and internal processes) were implemented. This concurred with a rising share of women among applicants and principal investigators.

	Because the FWF mainly funds basic research and not applied research, there is hardly any direct impact on products, services or processes and economic benefit. However, the gender policy of the FWF might influence the general discourse about gender in research and with this the gender culture in research institutions.
Scientific discipline	All disciplines
Industrial sector	
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	• Establishment of a staff unit for gender issues. • Measures to increase the awareness for gender equality in the organisation (awareness training, increasing share of women in boards and in the staff). • Measures to raise the share of female applicants (monitoring the share of women in grants, redesign of programmes). • Measures to ensure fair and equal treatment of female and male applicants (gender equality standards for external and internal processes).
Impacts	**Overall assessment**
	The measures concurred with a rising share of women among applicants and principal investigators.
	Society
	There is no data available if and how a gender dimension in research content is considered. As the FWF mainly funds basic research and not applied research, a direct impact on products, services, or processes might not be assumed. However, the gender policy of the FWF might influence the general discourse about gender in research.
	Democracy
	FWF interventions aim to increase female participation in funded research. An increase of female participation would also be a democratic benefit.
	Economy
	As the FWF funds basic research there is no direct implementation of results in markets. Hence, economic effects may not be assessed.
Causal link and limitation	

19 Institute of Gender in Medicine at the Charité University Medicine Berlin

Table 33: Analysis sheet CS19

Case number	**19**
Case title	Institute of Gender in Medicine at the Charité University Medicine Berlin
Short abstract	The Institute of Gender in Medicine (GiM) at the Charité Medicine University in Berlin was founded in 2003 with the aim to integrate gender aspects in medical research, particularly of cardiovascular diseases. The GiM does not only conduct research in national and international context, but is also engaged in teaching and education activities, development of guidelines and standards, networking, and theme setting activities.
Scientific discipline	Medicine/Health
Industrial sector	
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	Establishment of a visible **research group** on gender medicine at the Charité. The core objective of the GiM is the systematic integration of gender aspects in (cardiovascular) research. The institute subdivides its research activities into (a) basic research, (b) clinical research, (c) prevention research, and (d) research on gender medicine education. Specific research projects with specific results.
Impacts	**Overall assessment**
	Society
	• Better diagnosis and treatment for women, especially considering heart diseases.
	Democracy
	• More justice through the consideration of particular needs of 50% of the population. • The effects occur not only at a national level (Germany), but also Europe-wide, as the GiM is very active in EU research projects.
	Economy
	• New medication, treatments, information. • Increased knowledge on improved diagnostics, drug development, therapies, and consequently a better life expectancy. • Better suited theories, methods and models, evidence-based therapies.

	• Improved health system.
RRI activity/measure II	
Description of RRI activity	Aiming to promote young scientists, the GiM coordinated a DFG-funded **graduate group** on "Gender specific mechanisms of myocardial hypertrophy" (2004-2011), an activity which is followed by the initiative "Young CCR" at the Centre for Cardiovascular Research where Master's, PhD, and MD students receive the opportunity to work on cardiovascular research.
RRI activity/measure III	
Description of RRI activity	The head of the institute led a group that compiled the **European guidelines** "Management of Cardiovascular Diseases in Pregnancy".
RRI activity/measure IV	
Description of RRI activity	**Networking and dissemination activities:** The GiM organised respectively organises numerous events, including large symposia on Gender Medicine; establishment of journals like Gender Medicine (available for 2004-2012) or Biology of Sex Differences (BioMed Central, Open Access publisher, http://bsd.biomedcentral.com/).
RRI activity/measure V	
Description of RRI activity	Promotion of mainstreaming of gender and sex differences in **medical education** in the sense that gender medicine becomes an integral part of the medical curriculum, in form of elective but also mandatory courses. • Master's module "Gender Medicine" with six partner universities: promoting awareness and knowledge regarding gender-sensitive medicine. • ERASMUS project EUGIM to develop European curriculum on Gender Medicine. • Elective course "Gender-related Medicine": transferring gender research (regarding differences in pathogenesis, clinical features, prognosis, but also diagnostic and therapeutic options) into clinical practice. • Project for the development of sex/gender-specific learning objectives in general medical education. • Further target groups like general practitioners, dentists, pharmacists, and students of health sciences are addressed by training activities like a seminar on genders-sensitive medicine.
Impacts	**Overall assessment**
	Society
	Through a broad integration of gender aspects into the medical curricula, it is expected that the next generation of researchers and practitioners will be more sensible and trained to apply the existing gender knowledge into practice. It is assumed that this will lead to improved diagnosis, therapy, and health care for women, but also for men.
	Democracy

	Economy
Causal link and limitation	
RRI activity/measure VI	
Description of RRI activity	Improved awareness towards abuse among clinical practitioners, the shaping of suitable workplace environments.
Overall assessment of all GiM activities	
Impacts	**Society**
	• Positive effects on education, health, quality of life, prevention. • Better diagnosis and treatment for women, especially considering heart diseases.
	Democracy
	• More justice through the consideration of particular needs of 50% of the population. • The effect on policy-making bodies is, due to the above mentioned time restrictions, less strong than it could be if more basic funding would be available. • The effects occur not only at a national level (Germany), but also Europe-wide, as the GiM is very active in EU research projects.
	Economy
	• Increased knowledge on improved diagnostics, drug development, therapies, and consequently a better life expectancy. • Better suited theories, methods and models, evidence-based therapies. • Improved health system. • Cost savings (see below).
Causal link and limitation	For methodological reasons it is difficult to "measure" a causal impact of the institute's work, but based on the numerous and diverse activities described above, it is reasonable to assume a strong impact on the development of gender in medicine. Moreover, as the regular evaluations lead to steady positive assessments, the outputs and outcomes are obviously satisfactory. The main challenge of this case study was that despite the existing knowledge about the relevance of gender-sensitive research and practice in medicine, the situation is far away from being developed in a way that concrete impacts can be identified on a quantitative basis.

	There are numerous well-documented examples of cost-saving when improving the health and well-being of 50% of the population (see the website on gendered innovations, http://genderedinnovations.stanford.edu/, but also single articles like Biermann et al., 2012), but experimental designs to prove causalities are – also for ethical reasons – hardly to be established.
Discussion/Limitation of data	
Overall assessment of data quality	The case study is based on publicly available information – for example the institute's website –, a personal interview with the head of the GiM, and further studies, respectively literature on benefits of the (intensified) consideration of gender aspects in medical research and practice. Thus, the information this case study is based on is primarily qualitative.
Possible indicators	• Publications in peer reviewed journals with a focus on gender medicine. • Number of university courses/further education on gender medicine. • Reach of gender medicine journals. • Patents/medication/treatments resulting from the work of the GiM. • Consideration of gender medicine aspects in research/diagnostics/treatment policies.

20 The European Bioinformatics Institute (EMBL-EBI)

Table 34: Analysis sheet CS20

Case number	**20**
Case title	The European Bioinformatics Institute (EMBL-EBI)
Short abstract	This case is about the economic impact of the activities of the European Bioinformatics Institute (EMBL-EBI) in managing and providing Open Access to life science data for the scientific research community. EMBL-EBI also conducts basic research as well as provides training and pre-competitive collaboration for public and private researchers.
Scientific discipline	Molecular Biology
Industrial sector	
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	The EBI was established in 1992 and is one of the five operative locations of the EMBL (European Molecular Biology Laboratory). Its core activity is to **gather, curate, and maintain a library of data resulting from life science experiments**, covering the full spectrum of molecular biology, which is supplied without financial cost to researchers (Beagrie and Houghton, 2016, p. 7). The EBI is one of the most important providers of open data to the global life science.

<table>
<tr><th colspan="2">RRI activity/measure II</th></tr>
<tr><td>Description of RRI activity</td><td>In the EMBL-EBI case, training is an extensive activity, including for PhD students, researchers, staff, and industry. Online training in 2014 was reported to have almost 6,000 registered users, double that in 2013 (EMBL-EBI, 2015, p. 40). Training has grown in line with the expanding demand for EMBL-EBI data and services; from a handful of workshops in 2007 to a full programme with face-to-face courses reaching more than 7,000 people at 200 sites globally and an online resource reaching 100,000 professionals in 2013 (EvaRIO, 2013). (Source: http://www.embl.de/aboutus/general_information/)</td></tr>
<tr><td rowspan="6">Impacts</td><td>Overall assessment</td></tr>
<tr><td>The case study only assesses the economic benefits of open data, and provides an overall assessment of those, not referring to the single activities, but taking all activities as one, from which benefits occur.
In terms of the impact and benefits of the open data RRI activity, interpreting economic outcomes or benefits will depend on how the beneficiaries of the activity are defined. The consultant report on the value and impact of the EBI divides beneficiaries into two broad classes: the “user community” and “wider society” (Beagrie and Houghton, 2016).</td></tr>
<tr><td>Society</td></tr>
<tr><td></td></tr>
<tr><td>Democracy</td></tr>
<tr><td></td></tr>
<tr><td></td><td>Economy</td></tr>
<tr><td></td><td>• Investment and use value – referring to users’ attribution of how much the good or service is worth to them.
• Contingent valuation – referring to giving monetary values to non-market goods and services based on user preferences.
• Efficiency impacts – referring to the costs and time-loss saved by users from not having to created or collect the data resource themselves.
• Return on investment – referring to the benefits (modified Solow-Swan model) accruing from the use of the open data and associated services (Beagrie and Houghton, 2016, pp. 14-17).
• The results of the assessment assign highly significant economic value accruing to the research user community from access and use of EMBL-EBI data services. The downstream impact on the wider community is also highly significant, including the additional return on investment in R&D that can be attributed to EBI.
The EvaRIO case study includes two assessments of the direct effects of using EMBL-EBI data and services, with one large firm and one SME. The large firm reported benefits including:
• 15-20 patent applications in 5 years that could not have been submitted without data provided by EBI.
• 20 million Euros (a minima expenses) of activities dependent on EMBL-EBI services in 2013.
• An estimated 150 million Euro economic benefit since entering the EMBL-EBI Industry programme.</td></tr>
</table>

	• One co-funded PhD and two publications (EvaRIO, 2013, pp. 4-5). The SME reported benefits including: • 350,000–500,000 Euros in activities dependent on EMBL-EBI services in first half of 2012. • One third of data used in drug design to commercial client obtained from EBI. • One patent and two publications from EMBL-EBI data (EvaRIO, 2013, p. 5). The economic benefits accruing to individual firms do not lend themselves easily to monitoring metrics. Nevertheless, standard indicators of publications and patents that are based entirely or in part may be useful proxies for such impact, as there seems to be connections between economic returns and such outputs in the cases observed. In terms of the level at which the RRI activity can be monitored through data collections, the estimation of economic impacts of open data repositories such as EBI can be approached at the user/firm level, whilst such benefits can also be attributed to regional/national levels to some degree.
Causal link and limitation	It would likely be premature to try to associate specific economic benefits to directly resulting from the outcomes of open data use. At this descriptive level, the multiple data sources and methods applied suggest that metrics that can underpin input-output indicators for the open data dimension of RRI. An analytical approach would need to be taken to assess whether there are options for designing indicators with the degree of coverage that could be useful for a monitoring task. It seems clear that input-output metrics of open data initiatives can be constructed in terms of volumes of data, data usage, and user communities. Intuitively such metrics would centre on the log data, user surveys, etc. from particular repositories. While a quite detailed picture could be drawn of these open data activities and their value to clients, the question of national or other bases of comparison for a monitoring framework seems somewhat problematic, with the possible exception of the provenance of datasets and instructions for use that are included into the platform. In terms of metrics that can quantify, in monetary values, the economic impacts or benefits of open data, the case study includes a range of methods. The collection of user survey data seems critical in this regard, as assessing the cost to users, or willingness to pay of individual firms or other entities, will be linked to their specific R&D and/or product-market strategy and will therefore be contingent on this strategy and management approach, Analysing the proportion of open data used in conjunction with proprietary data appears to be one potentially useful metric for assessing the contribution to open data to firm revenue or turnover. If one quarter of the data used to develop a product or drug design that is licensed for example, then a proxy measure of economic outcome could be one quarter of the turnover associated with this product or drug design.
Discussion/Limitation of data	
Overall assessment of data quality	The online presence of EMBL-EBI as well as all publicly available information were reviewed. Of particular interest is a recent study of the economic impact of EMBL-EBI services. This study uses a variety of techniques to estimate the value and impact of EMBL-EBI services in monetary terms. The findings of this study are used as a proxy for the economic benefits of RRI activities on the Open Access dimension. A fourth source was a case study of EMBL-EBI compiled as part of the EvaRIO project. Measurement of RRI activity for openness can only be done at the input level, such as the number of open datasets made available, data requests, the amount of data downloaded, or amount of time spent connected to the data platform. Data

	can also be easily obtained to show the number of unique IP addresses visiting EBI and the geographic location of users. Data on the provision and access to data at EMBL-EBI has the advantage of being traceable over a relatively long time series, although adjustments and improvements to the quality of data collected will have occurred during this period. In terms of assessing the economic benefits of open data, a quite comprehensive study has been conducted utilising a multi-method approach to capturing the "economic value and impact of EMBL-EBI data and services" (Beagrie and Houghton, 2016, p. 11). It is not immediately clear to what extent methods for capturing the economic value of open data services can be used as a proxy for economic benefit as it is understood in the framework of MoRRI. There are likely to be some convergences and some inconsistencies between these approaches. In the EMBL-EBI study, economic value largely refers to the value of the data services to the user community. Economic impact refers largely to the impact on the wider society (Beagrie and Houghton, 2016). In MoRRI terms, economic value may thus be thought of as directly capturing RRI inputs, whilst economic value refers to estimates of RRI outputs-outcomes benefits. Data collection requires mainly quantitative capture of web-based information. There are technical challenges but at least in the case on input indicators these seem relatively straightforward. In addition to such quantitative metrics, the potential of user surveys to track evolution in access to and use of open data is apparent from the EMBL-EBI case. EBI conducts an annual user survey, which has the potential to also contribute to RRI indicator development, not least in the identification of critical factors that may require a monitoring framework. In terms of the level at which the RRI activity can be monitored through data collections, the online environment provides potentially different levels of aggregation that could be captured. These include organisation/institution and country levels. Monitoring at these levels could be broadly focused on either contribution to open data resources or on use of open data resources.
Possible indicators	Potential input indicators: • Aggregation of open data/datasets. • Volume of data available in the EBI repository. Potential output indicators: • Number of data requests. • Number of data users. Process indicators: • Training or documentation on using open data and the open data platform. • The role EMBL-EBI open data plays in the total work programme of individual researchers, research groups, RPOs, projects, or programmes. Delineating how many hours per week, out of a total working week, were spent using open data platforms or downloaded data could be the basis of a metric for indicator development. Survey or logbook methods would be needed to develop such a metric.

21 Promoting Citizen Science at the ETH Zurich

Table 35: Analysis sheet CS21

Case number	**21**
Case title	Promoting Citizen Science at the ETH Zurich
Short abstract	At the ETH, the notion of citizen science has attracted the attention of several departments and the administration at the same time. After a period of investigation and gathering knowledge from global sources, the administration has decided to join forces with the University of Zurich and promote a concept where the universities would play a central role not only in terms of research responsibility, but also of governance and funding of citizen science projects. Funding has been ensured and the implementation of the new approach is in progress.
Scientific discipline	Astronomy, Medicine, Transport
Industrial sector	
Analysis of RRI dimension and benefits	
RRI activity/measure I	
Description of RRI activity	• Discussion of citizen science standards (to be adopted in 2016). • Paving the way for the creation of a competence centre.
Impacts	**Overall assessment**
	Since the measures are not yet implemented, there is no impact yet.
	Society
	n/a
	Democracy
	n/a
	Economy
	n/a
Causal link and limitation	

Annex IV: Raw lists of potential RRI benefits, by RRI dimension, by type of benefit

Task 6 of the MoRRI project produced a set of outputs, potential RRI benefits, which were the principal input to Task 7. Task 6 developed a raw list of potential benefits from multiple sources, including project reviews, a series of case studies, and a Visioning Workshop focused on expert opinion. For methodological reasons, related to our preference to be open and inclusive at the outset of our modelling approach (section 3), this extended raw list of potential benefits was used as the input for Task 7. A synthesised, reduced final list of RRI benefits was also specified in Task 6 (European Commission 2016b: 7-9). Unsurprisingly, given the common original source, the list of potential benefits of RRI by RRI dimension produced through the Task 7 modelling approach (Table 4.1) maps quite closely onto the final Task 6 list.

Table 36: Potential RRI benefits of Public Engagement, by type of benefit

Democratic	Economic	Societal
- Increases and deepens citizen participation in the political decision making process - More informed choices by broadening the basis for political decision-making - Empowerment of citizens and local citizens by participatory methods - Knowledge of citizens and locals can be taken into account - Increases citizens' political awareness and understanding of political matters - Institutional learning towards public engagement in policy-making - Researchers learn about public engagement and increase their skills in participatory methods - Unreflective public engagement closes down vital debates in contentious areas - *Increase of trust of society in policy-making* - *Increasing number of productive interactions in R&I policy-making* - *Increase of interest in/attractiveness of R&I policies*	- New and different outcomes which would not be possible without PE - Positive effects (e.g. on sustainability) because of new procedures - Previously unavailable data becomes accessible to researchers because of participatory methods - Cost-effective data collection because of citizen involvement - Other actors can use open source data - Mobilising funding from third actors - Farmers develop greater awareness regarding their land and therefore check it for certain characteristics - New research topics emerging from community needs	- Changes the scientific community's approach to the risks, uncertainties and wider social implications of new and emerging technologies - Citizens and locals gain competences on certain issues - Stimulation of public debate on certain issues - Increased knowledge about certain topics - New networks and network coalitions on certain issues - Facilitation of communication between actors and actor groups - Trust building between actors - Insights into citizen science - Support of citizen science as a concept - Change of awareness for certain topic and behaviours - Outreach to disadvantaged groups and communities - Improvement of curricula - Higher openness in society towards certain topic - New research on topics addressing RRI aspects - *Increasing interest in science*

Table 37: Potential RRI benefits of SLSE, by type of benefit

Democratic	Economic	Societal
- Well-informed citizens and policy-makers might make better choices - An informed public might be a public that is more engaged in certain topics - Supports students with different abilities and increases their knowledge	- More information might lead to higher acceptance of R&I - Knowledge and information are a prerequisite for open innovation and citizen science which again might lead to broader acceptance, higher market share and competitiveness	- Creates awareness of the impact of science and technology on society - Increased understanding, interest and motivation for a certain topic - Potential increase in students and science-trained labour force - Potentially increased image of science by better information - *More lifelong learning*

Table 38: Potential RRI benefits of Gender Equality, by type of benefit

Democratic	Economic	Societal
- Increase of female researchers is an intrinsic democratic benefit - Including untapped human resources - Needs of 50% of the population are considered - Potential effects on policy-making - Effects not limited to national level, but also on European level via European projects	- Integrating methods of sex and gender analysis into research produces excellence in science, health and medicine, engineering research, policy, and practice - Higher individual and collective performance might lead to higher output, company performance, to higher economic revenue in the end - Greater involvement of women can increase the quality of research projects (better targeted products) and strengthen the competitiveness of the company and the region - Improved (better matching) medication, therapies, information - Increased life expectancy because of improved models, methods, diagnostics, drug development, and evidence based therapies - Cost-saving - *Potentially increased job satisfaction/ motivation (policy-makers, innovators, researchers) in academia & industry*	- Increase of female researchers is an intrinsic societal benefit - Excellence in science, health and medicine, engineering research, policy, and practice - Ensures excellence and quality in outcomes, and enhances sustainability, adds value to society by making research more responsive to social needs and to business by developing new ideas, patents, and technology - Contributes to excellent research by the diversity it brings to research teams and through the analysis of research content by gender - Develops a more diverse science and engineering workforce - Improves corporate financial performance - Improves diagnosis and treatment of female patients - Positive effects on professional education, health, quality of life, prevention

Table 39: Potential RRI benefits of Ethics, by type of benefit

Democratic	Economic	Societal
- *Reduction of R&I related conflicts*	- Saved litigation costs because research misconduct is reduced and conflicts mediated - Reputational gain for research organisations and therefore increased chances for funding - Increased focus by firms on corporate social responsibility (CSR), leading to increased value of goodwill accruing to CSR activities	- Awareness for research integrity and ethics on a daily basis and clarification of these issues - New institutional practices - Fair science might lead to institutional change and greater attractiveness of science for students - Decrease in scientific misconduct - Increased confidence in science - *More companies receiving rewards for responsible conduct (e.g. environmental, social, ethical)*

Table 40: Potential RRI benefits of Open Access, by type of benefit

Democratic	Economic	Societal
	- Uptake of open data enables to establish a latent value, to stimulate innovation and to increase transparency - Firms could use data they obtained from OA activities - Share of R&D activities that depend on OA - *Potentially increased effectiveness of public investment in R&I*	- Advances/stimulates diffusion of knowledge - Fast sharing of results - Authors get more visibility and recognition as authors and scientists